

A WEEKLY JOURVAL 0F PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.


WORK ON THE CORINTH CANAL.
For centuries the Isthmus of Corinth, separating the Gulf of Corinth, which is about in the center of Greece, from the Gulf of Ægina, has attracted particular attention because of the barrier it presented to navigation between the Black and Adriatic Seas and the intermediate ports. A cana by the Roman Emperor Nero, and the canal now being excavated is on a line nearly identical with the one adopted at cavated is on a line nearly identical with the one adopted at
that time. Three attempts, previous to Nero, had been made to build the canal, and at the Ægina end there is a depression about 130 feet wide at the bottom, and about $\mathbf{5 , 0 0 0}$ feet long, while at the west side the work can be traced for 6,500 feet from the shore. At intervals along the line are square shafts, the walls of which are perfectly preserved.
The route extends in a perfectly straight line, is 20,800 feet long, and the most formidable ridge encountered is 256 feet higb. The canal will have the same width as that at Suez, 75 feet, and will shorten the vovage from the Adriatic Sea to Turkey and Asia Minor by 185 miles. Work was begun in May, 1882, under a contract with a firm for the total sum of $\$ 5,280,000$. French capital is invested in the project.
The general plan of working is as follows: The approach-es-about 600 feet on each side-will be deepened by the aid of land excavators, dredges, and pumps, the amount of material being about $3,330,000$ cubic yards. The dredges are provided with both buckets and claws, so as to be operated in both mud and loose rock, and each will raise from 500 to
600 tons per day of twelve hours. The pump will raise from

2,300 to 2,600 cubic yards of sand per day. To open the main cut, a tunnel wide enough for a double line of rails is first driven through at an elevation of 154 feet above the sea level, after which vertical shafts will be sunk to the evel of the tunnel.
The tops of the shafts will.be widened out on the line of he axis of the canal, the excavated material being thrown down the shafts to the tunnel, where trains remove it to the valleys adjoining the canal. That section remaining below he tunnel will be removed by drills and dynamite, working it in benches. Holes will be drilled about 160 feet deep and 4 inches in diameter-reaching to the bottom of the canaland will be spaced from 6 to 13 fect apart, according to the nature of the material. The rock will be broken into small pieces and cast down into the bed of the canal, where it will be raised by powerful dredges and discharged into barges, which will carry it to sea and dump it. The tal mass to be removed in the entire canal is $0,730,000$ cubic yards, and it is estimated that $2,460,850$ pounds of dyamite will be required.
Two 300 horse power marine dredges (one of which is illustrated upon this page), built by Demenge \& Satre, of Lyyons, France, are now at work upon the canal. The hull of the dredge is of iron, and is 129 feet long by $31 \cdot 16$ feet wide. The normal running speed of the buckets is fourteen
er minute, or during a day of ten hours 8,400 bucket load will be raised, this being equivalent to 7,560 cubic yards, since each bucket bas a capacity of nine-tenths of a yard; but the average work for ten hours in gravel, in the Soane, but the average work for ten hours in gravel, in the Soane,
was 6,500 cubic yards. The machinery is driven by two
coupled engines of 150 horse power each. All the frame work and bracing are of iron. The bow of the hull is divided to permit the entrance of the bucket arm and the chain of buckets, and at each outer end is a frame, both of which are united at the top by a crosspiece that supports the pulleys carrying the chain by which the free end of the arm is raised or lowered. The excavated material is diverted by a central apron and chutes to either side of the dredge, where it is re ceived by barges which are towed to sea as fast as filled
The total population now connected with the work is 2,300. According to the present progress, it is expected that it will be completed in 1886. The total expenditure up o June 28 last was $\$ 1,700,000$.
For the loan of the photograph from which our engraving was made, and for notes concerning the dredge, we are indebted to the courtesy of Mr . Colne, of the Interoceanic Canal Co.

THE project of cutting a ship canal across the province of Holstein, connecting the North Sea with the Baltic, is now being taken up by the German authorities in earnest. The canal is to run from near the mouth of the Elbe to the arbor of Kiel, Germany's chief naval port on the " Ostsee.' It is to be constructed of such dimensions as to permit he largest ironclads in the German navy steaming from he Baltic to the German Ocean, or vice versa, thus avoiding the necessity of making, as at present, the long voyage ound the peninsula of Jutland. Detailed drawings of the subject are to be submitted to the new Reichstag.


THE CORINTH CANAL.-THE THREE HUNDRED HORSE POWER MARINE DREDGE ISTHMIA,

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## THE EARTHQUAKE OF AUGUST 10.

ents of people living in the United States, except resi dents of the Pacitic Coast, had ever felt a decided earth
quake shock previous to the afternoon of Sunday, Aug. 10 when one was experienced on the Atlantic seaboard from Maine to Virginia, extending as far inward as West Vir ginia, and over the greater portion of Pennsylvania and New York. The shock was most severely felt on the south shore of Long Island, near New York city, and in the south shore of Long Island, near New York city, and in the south-
ern part of the city itself, and the adjacent coast of New Jersey, between 2:5 and 2:7 P.M. The length of its dura tion is variously given at from five to twenty seconds, the latter interval probably including the beginning and ending of the tremor, not so plainly perceptible as the very violent shaking so plainly perceived by every one for from five to seven seconds. There was no damage done of any conse quence anywhere-only some glass and crockery broken, ceilings cracked, and loose chimney bricks dislocated-but the most massive buildings in New York were shaken to their foundations, and those who happened to be in third or fourth stories, or higher, felt that only slight additional orce would have been needed to bring down many structures and cause great loss of life. As it was, in several parts of New York city, and at the points near by where the shock was most felt, people rushed from the houses in fright, which it took some time to allay.
The state of the weather just preceding the shock-in the particulars of which are found so many portentous omens and neglected warnings in the great earthquakes of history -excited no comment bere. It was simply a continuation of the rather unseasonably cold and damp air we have had for several weeks, while Western Europe seems to have been getting our ordinary proportion of high temperature. There was a fresh northeast wind blowing, and the sky was cloudy, the thermometer registered $68^{\circ} \mathrm{F}$., and the barometer 30.082 inches. The motion of the shock was latera!, not vertical, as bas been more or less the case with the most destructive earthquakes, and its general direction was northeast and southwest. There was no observed tidal effect, vessels on the water not feeling it at all, except some tied up at docks broke their hawsers. A heavy rumbling sound, as of subter ranean thunder, was almost everywhere heard, with greater or less distinctness, 'but in the city this was generally attri buted to the rolling of heavy trucks on the pavement, o some similar cause, until after investigation showed the true cause.
The particular place where the earthquake originated af fords room for no little speculation. We really know nothing about it, but in accepting any set of facts we are par tially, also, adopting a certain theory as to the cause. The most prevalent opinion is that the starting point was not far from due east of New York city, and probably under the bed of the Atlantic. There are no facts to disprove, and many to support, the assumption that the interior of the earth is in a very highly beated state. If it is not in a fluid condition so largely as to :nterfere with its rigidity, which is counted equal to that of a ball of steel, this is said to be because of the great weight with which the exterior presses toward the center. Nevertheless it is steadily cooling, geologists claiming that it has required twenty-five millions of years to acquire its present externally solid form, and that during this period the mountains were formed and the hol lows of the seas made, by a sort of wrinkling of the surface as the globe of liquid fire and heated gases contracted to itspresent shape. According to this idea the solid crust of the earth extends down from ten to forty miles, there being beneath that a greater or less thickness of plastic material, from melted rocks, etc., under high pressure, while the crust of the earth is all the time in a bigh state of tension, from the gradual cooling of the interior causing cavities, and allowing the superincumbent earth to crowd down closer to its heated core. The access of water, also, by percolation from the earth's surface to these subterraneitn ovens, it is thought may in some cases cause explosions, dislocating vast quanti ties of material, and perbaps, by opening communication
with the still hotter portion yet lower down, be the cause of some of the most destructive volcanoes. These explanations are largely hypothetical, but they accord with all we know of the earth's surface, and they afford the best theory we yet have to account for earthquakes and volcanoes, as well as to
explain the present structural condition of the earth's surface. This crust of the earth we bave hardly made a pin scratch upon; but we know that the further we go down the warmer it is, the artesian wells which supply the city of Paris from a depth of nearly 1,800 feet yielding water of $82^{\circ}$ Fal., and the lower levels of the Comstock Mines having an almost uniform temperature of $130^{\circ} \mathrm{Fab}$. It is estimated
that the heat increases at the rate of that the heat increases at the rate of one degree for every fifty feet, and this would give a temperature to melt the hardest rocks in less than ten miles.
On this theory the present volcanic and earthquake re gions of the globe are located along the axis of these sup posed wrinkles or corrugations from the contraction of the crust thought to be at present in the state of greatest tension. The most marked of these are down the east coast of Asia, including the Japan and Philippine Islands, and ex tending to Java, where the great earthquake of last year oc curred. Another also extends down the Pacific coast of been very light in the northern part since the commence ment of historic times, but of whose presence in South America we have had many striking proofs. One also ex

Indian Ocean; another near the coast line of South America on the Caribbean Sea; and another, which gives every evidence of having not many ages since been a region of most terrific activity, extends northward along the western coast of Africa, the Azores, Madeira, Canary, and Cape Verde Islands, largely consisting of extinct volcanoes, and suggesting that they may be the surviving surface of the fabled island or continent of Atlantis, once said to connect Africa with America. A smaller volcanic and earthquake region is found near the southern part of the Italian peninsula. All of these localities have been the scene of violent eruptions within comparatively recent times.
The great Java earthquake of August, 1883, was perlaps the most severe, when the Island of Krakatoa was almost bodily carried away, a part of it seemingly having been used to form two small new islands at some miles distant, ard an indefinite portion sent into the atmosphere in such an atomized condition as to afford the best explanation we have had of the anomalous sunsets of the last year
Italian earthquakes have been numerous enough to make a catalogue, one of the earliest recorded having been that which partially destroyed Herculaneum and Pompeii sixteen years before they were finally covered with lava from an eruption of Vesuvius. From 1773 to 1776 there were no less than 947 shocks, 500 of which were of the first degree of force. One in Calabria in 1783 was estimated to have caused the death of 100,000 persons, and was felt in a great part of Europe. The latest considerable one, at Ischia, was confined in narrow limits, causing only about 150 deaths. In 1857 a severe earthquake visited the kingdom of Naples, doing little damage in the city, but much in the provinces, and this earthquake was made specially memorable by the investigations relating to it made by Professor Mallet, cf the British Association
By using the fissures in buildings, the disturbance of heavy objects, etc., as natural measurers, he fixed, from 177 determinations, the focus of the disturbance as being beneath the village of Caggiora, finding the mean depth of the cavity at $53 / 4$ miles. He also deduced the general form of the focal cavity as a curved fissure, 3 miles high, 9 miles long, and of very small thickness, the velocity of transit of shock being between 658 and 989 feet per second.
The great earthquake at Lisbon in 1755 was probably the most severe one felt in Europe outside of the Italian peninsula. The shock was felt in the Alps and on the coast of Sweden; 60,000 persons perished, and a part of the city permanently engulfed 600 feet beneath the bay. Among many others felt in Europe in 1878 was one which scems to have in many respects resembled the recent one herc. It occurred on August 26, and was not remarkable for its violence, but for the great extent of territory affected. It is estimated to have covered over 2,000 gengraphical square miles, ringing bells and swaying houses and making cracks in the walls, and was accompanied by a dull subterranean noise ; the workmen on the towers of the Cologne Cathedral saw the scaffolding oscillate and fcared for their lives, yet not one of 1,100 miners working 1,000 feet below in the mines noticed the disturbance. This was not so severe even as the shock felt in England last Spring, when some chimneys were thrown down, and many walls so $t \pi$ isted as to be cndered unsafe
In South America there have been numerous earthquakes within the last fifty ycars. Caraccas, in Venezuela, was enirely destroyed by three shocks, within fifty seconds, in 1812. The city of Quito, in Ecuador, was almost destroyed in 1859 nd in 1868 a large part of Ecuador was devastated by great earthquake, several shocks from the 13th to the 16 th of August occurring over nearly all South America. Thi was the date also of the earthquake at Iquique, Peru, when the U. S. war ship Wateree was lifted and left stranded two miles inland by a great tidal wave. The latter earthquake caused a wave more than 2 feet high at San Francisco, and California itself bas had many quite severe earthquake slocks. One that occurred there March 26, 1872, occasioned general alarm, and did a good deal of damage in San Fran cisco, cracking the walls of many fine buildings.
The nearest region of earthquake activity to our Eastern hores, however, is found in the West Indies. Here, on March 19, 1873, the city of San Salvador, about 300 miles due east of the southern part of Florida, was totally destroy d; three successive severe shocks were experienced, but the nhabitants had been so well warned by the previous noises that only some 500 lives were lost. The Atlantic States of he Union are thus, it will be seen, not very far removed from a region of recent volcanic activity, and belong to a section whose probable axis of seismic disturbance lies about as indicated by the recent earthquake, $i$. $e$., between the West Indies and Bermuda on the one side and the Appalach an range on the other, somewhat according to the course of the Gulf Stream. The number of minor disturbances in this region has been considerable, but far the largest proporion of them bave been so slight as almost to escape notice. The earthquakes already catalogued number about 9,000 , and it is estimated that one occurs on an average twice a week somewhere in the world, but our section of the world has contributed very little to this list, nor does the earth quake of August 10 afford any idea that we are more likely to have such disturbances in the future, except as it sug gests the ever present possibility, for us as well as all other people on the globe.
Proctor says: " The lifetime of a world like ours may be truly said to be a lifetime of cooling. Beginning in the glowing vaporous condition which we see in the sun and
stars, an orb in space passes gradually to the condition of a cool, non-luminous mass, and thence steadily onward toward inertness and death. Regarding our planet's state as that of mid-life, we may call that stage death in which these conditions have entirely disappeared. Among these conditions is the action of the subterranean forces by which the earth's surface is continually modeled and remodeled. Only by the action of her vulcanian energies can the earth maintain her position as an abode of life. She is then manifesting her intness to support life in those very throes by which, too often, many lives are lost. The upheavals and downsinkings, the rushing of ocean in great waves over islands and seaports, by which tens of thousands of human keings lose their lives, are part of the evidence which the earth gives that within her frame there still remains enough of vitality for the support of life during bundreds of thousands of years to come."

## SMELTING AND CASTING OF IRON

The metallurgical processes employed in the extraction of iron produce a metal which contains carbon, silicon, man ganese, and other substances. Pure iron, having a very higb fusing point, is not well applicable to foundry purposes; the material we have to examine is iron combined with carbon. The presence of carbon, it being combined and disseminated as graphite through the irou, causes a lowering of the fusing point. When pig iron is molten in a cupola furnace, the air comes in contact with particles of the liquid metal and the carbon thereof; the metal is partly decarbonized. The impurities, silicon, manganese, and small quantity of iron are converted into oxides, producing the slag
Other products of oxidation, carbonic oxide and iron oxide, are dissolved in the molten iron. The air blown into the furnace generally contains aqueous vapor, and by its action upon burning coke hydrogen is generated. Molten iron, possessing the property of dissolving three times its volume of hydrogen, as has been shown by latest investigations, is thus charged with carbonic oxide, bydrogen, and iron oxide. On cooling of the metal the gases are emitted; they are the cause of the spongy, pumicestone-like surface structure observed on solidified metallic masses.
Iron being molten at a low temperature, and then tapped off and poured into moulds, liberates the dissolved gases within the mould. The structure of such a casting exhibits the presence of cavities and a high degree of porosity. Such cavities bave pease-like shape near the surface, and assume that of a sphere toward the center of the metal; they are sometimes conuected with each other by small chanuels. When beated more rapidly and far above its fusing point, iron becomes more applicable to foundry purposes. The molten metal remaining for some time in the ladle and being agitated by the aid of a bar before it is poured into the moulds, permits a free eliberation of dissolved gases.
The property of iron of absorbing gases and iron oxide is increased by remelting of iron; for homogeneous castings iron must be used which has not previously served the same purpose. The spongy structure of a casting is also caused by the moulding material. When the orifices of a mould become gradually filled with molten metal, the escape of gases depends on the physical nature of the moulding material. The latter containing moisture and organic substances generates aqueous vapor and other gases, which cause the formation of surface cavities. These cavities are covered with a film of oxidized metal, while those produced by dissolved gases have a bright metallic surface.
The difficulties involved in the casting of homogeneous articles are partly overcome by the use of a suitable porous
sand. Another class of cavities is that called druse. The sand. Another class of cavities is that called druse. The dritic form . The formation of these cavities is caused by an abnormal shrinkage during solidification. Another phenomenon generally called sucking must be assigned to the same cause; it is generally observed on parts of castings where a large quantity of metal has been collected. It is therefore advisable in the manufacture of castings to give them an equal wall thickness, which has the advantage that
the tension is most equally distributed throughout the mass. On cooling of the liquid metal within the mould, the particles which are in contact with the mould are sooner solidified than those more distant, and promote a motion of the liquid material from places of greatest to such of less accumulation, thus forming druses.-Metallarbeiter.

## cooling by evaporation.

The principle of cooling by evaporation is one on which some ice making machines are constructed; ether or aqua ammonia applied to the skin when heated produces a cooling effect by its rapid evaporation; a playing spray fountain in a room will sensibly cool the air from the same cause. Under favorable circumstances this principle may be economically applied to the cooling of overheated rooms. Many years ago the proprietor of a summer boarding bouse in eastern Massachusetts cooled his upper rooms in summer by spraying water through an air duct, the plan being
almost identical with that described in an exchange as being employed in the composing room of the New Orleans Picayune. In this case a vertical wooden box was constructed in the corner of the room, with openings at the floor and reiling, and furnisied with a pipe for supplying water at
the top, and a pan and drain at the bottom for receiving the the top, and a pan and drain at the bottom for receiving the
flow and carrying it safely away. The supply pipe was bent over the upper end of the shaft, and fitted with a nose like that of a watering pot, so as to deliver a shower of spray in-
stead of a solid stream. On connecting it with the service pipe the movement of the water was found to cause an active circulation of the air in that part of the room, which was drawn in at the upper opening of the shaft and issued again cool and fresh from the one at the floor level.
The relative temperatures of the water, the air al the top of the room, and the cooler air that had passed the water bath were: Water, $84^{\circ}$; air in the room, $96^{\circ}$; cooled air, $74^{\circ}$; showing that the air was cooled ten degrees below the temperature of the water which cooled it. This refrigeration was due to the rapid evaporation of the water by the heated air, the water being in the form of a fine spray.

## THE EFFECT OF HARDENING ON STEEL.

A correspondent, in referring to an article on the "Contraction of Steel," in the Scientific American of July 12 water stcel workers differ as to the effect of fire and the steel and others being certain that the process contracts it. Both of these conditions after hardening were alluded to in that article, and on these varying facts was based a suggestion that workers in steel keep a record of the behavior of the metal of the same bar, the same lot, and also of different makers.
The correspondent suggests that the managers of this paper institute and carry on to completion a comprehensive series of experiments to determine what changes, if any, are made in cast steel by the process of hardening. It is obvious that the proposition is not a feasible one; the duty of recording mechanical experiments is eutirely distinct from the opportunity of making them or of conducting the processes of the trials.
But such trials and tests are being made by those who have not only all the ready means to make them, but are financially concerned in their results. The facts upon which the article in the July 12 issue was based were taken from very comprebensive tests made by a large manufacturer of steel tools, some of them necessarily of the most exact character. The variations in the bchavior of steel from the same makers were almost incomprehensible, if the belief in the uniformity of the product was allowed; and the exact tests and records of the action of bardening on the steels of five of the foremost makers of steel in the world demonstrated the fact that at present there is no certainty
in the homogeneousness of steel, so that it retains its certain in the bomogeneousness of steel, so that it retains its certain
and absolute character in the after workings. Of this general fact there can be no question; and producers of cast steel and workers of cast steel are acting quite in harmony, to the end that a uniform product may be obtained. The difficulties in the way of this desirable success are obvious enough; it is almost impossible, at present, to know the actual qualities of the iron and of the other added ingredients that go to make up the steel
Not only do the ores from the same mine differ, but their after handling differs in quality of fuel and degrees of heat. And even the chemical products employed are not always the same in quality. When to these invitations to variation is added the carelessness of the forger and temperer, it is easy to see that only a long continued series of tests, carefully recorded, can ascertain the causes of difference and suggest the remedies. But there is going on a gradual improvement; and one of its evidences is the mechanical in telligence that demands special steel for special purposes. That this demand is met, at least in part, is evidence that an improvement in the methods of producing determinate qualities and similar, if not exact, results is possible.

## Chemical Nature of Starch Grains.

Dr. Brukner has contributed to the "Proceedings of the Vienna Academy of Sciences" a paper on the "Chemical Nature of the Different Varieties of Starch," especially in reference to the question whether the granulose of Nägeli, the soluble starch of Jessen, the amylodextrin of W. Nageli, and the amidulin of Nasse, are the same or different sub stances.

A single experiment will serve to show that under certain conditions a soluble substance may be ohtained from starch grains. If dried starch grains are rubhed between two glass plates, the grains will be seen under the microscope to be fissured, and if then wetted and filtered, the filtrate will be a perfectly clear liquid, showing a strong starch reaction with iodine. Since no solution is obtained from uninjured grains, even after soaking for weeks in water, Brukner concludes that the outer layers of the starch grains form a membrane protecting the interior soluble layers from the action of the water. He was unable to detect any chemical differences bet ween the amidulin of Nasse, the portion of the
starch grain solub!e in water, and the granulose of C. Nägeli, which solub!e in water, and the granulose of ble filtrate from starch paste also contains a substance identical with granulose. Between the two kinds of starchthe granular and that contained in paste-there is no chemical but only a physical difference, depending on the condition of aggregation of their micellæ.
W. Nägeli maintains that granulose, or soluble starch, differs from amylodextrin in the former being precipitated by tannic acid and acetate of lead, while the latter is not.
Brukner fails to confirm this difference, obtaining a voluminous precipitate with tannic acid and acetate of lead in the case of both substances. Another difference maintained by Nägeli, that freshly precipitated starch is insoluble, amylodextrine soluble, in water, is also contested; the author find ing that granulose is soluble to a considerable extent in
water, not only immediately after precipitation, but when it as remained for twenty-four hours under absolute alcohol Other differences pointed out by W. Nägeli, Bruckner also maintains to be non-existent, and he regards amydulin and amylodextrin as identical.
Brucke gave the name erythrogranulose to a substance nearly related to granulose, but with a stronger affinity for iodine, and receiving from it not a blue but a red color. Brukner regards the red color as resulting from a mixture of erythrodextrin, and the greater solubility of this substance in water. If a mixture of filtered potatostarch paste and ery throdextrin is dried on a watch glass, covered with a thin pellicle of collodion, and a drop of iodine solution placed on the latter, it penetrates very slowly througb the pellicle, the dextrine becoming first tinctured with red, and the granulose afterward with blue. If, on the other hand, no erytbrodextrin is used, the diffusion of the iodine causes at once simply a blue coloring.

With regard to the iodine reaction of starch, Brukner contests Sachsse's view as to the loss of color of iodide of starch at a high temperature. He shows that the iodide may resist heat. and that the loss of color depends on the greater attraction of water for iodine as compared with starch, and the greater solubility of iodine in water at high temperatures.
The different kinds of starch do not take the same tin with the same quantity of (solid) iodine. That from the potato and Arum gives a blue, that from wheat and rice violet tint; while the filtrate from starch paste, from what ever source, always gives a blue color.

## Salicylic Acid in Beer.

Some interesting experiments by Heinzelmann have been published, which offer additional proofs of the value of salicylic acid as a preservative agent, for they show that this antiseptic, when used judicionsly, really strengthens and encourages the growth of yeast. The author's experiments show that, although the vitality of yeast is completely destroyed by the presence of 0.03 per cent of salicylic acid the addition of only 0.01 per cent actually favors its greatest activity, and further, that the yeast cells developed in the presence of this proportion of salicylic acid are stronger and larger than those produced in a solution free from this acid; moreover, the production of alcohol in a given time is said to be greater. The addition of 1 part of salicylic acid to 10,000 parts of the mash is said to favor fermentation, especially when sugar is used
In two series, each of three experiments, Ladurean em ployed (1) beer alone and beer mixed respectively with (2) 100 and (3) 200 grains per barrel. The three beers were ex posed to the air for two weeks, and subsequently closed up for a month, after which period they were examined. The beer 1 without salicylic acid was sour, beer 2 was only slightly sour, and beer 3 not at all. To complete the investigation, the salicylated beer was employed for dietetic purposes for several weeks without any deleterions effect on the health of the experimenter. It is therefore clear that the addition at most of 250 grains (about one-half ounce) per barrel preserves the beer without affecting its use as a beverage. The author defends the use of salicylic acid, and maintains that a prejudicial amount would never be added, owing to the facility with which salicylic acid may be accurately estimated.

## The Antiquity of Mercury.

A recent writer in the North China Herald discusses the part played by mercury in the alchemy and materia medica of the Chinese Cinnabar was known to them in the seventh century before the Cbristian era, and its occurrence on the surface of the earth was said to indicate gold beneath. Their views on the trabsformation of metals into ores and ores into metals by heat and other means took the form of a chemical doctrine about a century before Christ, and there is now no reasonable.doubt that the Arabian Geber and others (as stated by Dr. Gladstone in his inaugural address to the Chemical Society) derived their ideas on the transmutation of metals into gold and the belief in immunity from death by the use of the philosopher's stone from China. Among all the metals with which the alchemist worked, mercury was pre-eminent, and this is stated to be really the philosopher's stoue, of which Geber, Kalid, and others spoke in the times of the early Caliphs. In China it was employed excessively as a medicine. On nights when dew was falling, a sufficient amount was collected to mix with the powder of cinnabar and this was taken babitually till it led to serious disturbance of the bodily functions. In the ninth century an emperor, and in the tenth a prime minister, died from overdoses of mercury. Chinese medical books say it takes two hundred years to produce cinnabar; in three hundred years it becomes lead; in two hundred years more it becomes silver, and then by obtaining a transforming substance called "vapor of harmony " it becomes gold. This doctrine of the transformation of mercury into other metals is 2,000 years old in China. The Chinese hold that it not only prolongs life, but expels bad vapors, poison, and the gloom of an uneasy mind.
Mineral wool is used for a packing to deaden the sound between floors in buildings, and being incombustible it is now pretty generally used between the floors and ceilings in new houses. Mineral wool is obtained from the slag from blast furnaces, and is produced by throwing a jet of steam against the stream of slag as it flows from the furnace.

## BACK BAND BUCKLE

The main frame of the buckle is formed with two paral lel transverse slots, through which the back band, B, passe from the back, and between which is a third slot in which is pivoted a clasp plate, Fig. 3, that curves in reverse direc tions at each side of its pivot to form the opposite clasping edges. The back band is passed through the slot in the plate, as shown in Fig. 1. It is apparent that any downward pull upon the buckle will act by the pressure of the band upon the upper half of the plate, and above its pivots to force the clasping edges firmly upon the band at the reverse sides of the frame. The edges, D E, are formed with prongs to secure a firmer hold of the buckle on the band.


## pender's back band buckle.

At the lower edge of the buckle frame is a downward extension, on the face of which is formed a hook, G, whose point reaches nearly to the plane of the face of the frame. By this means a space is secured between the main body of the hook and the frame in which the trace chain may be supported. In placing one of the trace links upon the hook, it may be pushed partly into the opening in the extension. A loop, I, formed on the extreme end of the extension serves to hold the rein up from the ground. The band passes over the animal's back, and carries a buckle with trace and rein hooks near each end and at each side of the animal The double hold of the clasp plate upon opposite faces of the band affords greater security against tearing aud slipping than a single toothed edge acting on one face of the band would.
This invention has been patented by Mr. P. S. Pender, and further information can be obtained from Messrs. S. S. Nash \& Co., of Tarboro, N. C.

## SEMICIRCULAR POINTED PENS.

The accompanying illustration shows a new manner of making metallic pens, whereby their durability is increased, they will hold a greater quantity of ink than ordinary pens, and their points are so formed as to preclude scratching, no matter in what position the pen is held. The pen is made with slight projections or flaps attached to the edges of its body, and bent inward toward the concave portion to form an open reservoir. The small trausverse section at the bottom indicates the manner in which these reservoir attachments are shaped to feed the ink to the point of the pen. The point is rounded or bulged to a half ball shape, allowing the pen to touch the paper with the same roundness whether held slantingly, flatly, or sideways, and write equally well

in any position, while the slit parts neverform cutting edges, as is the case with ordinary pens, and the point of the pen is always supplied with ink, since it acts as a minute reservoir, which is constantly supplied with ink from the larger reservoir formed by the flaps at the side. This construction is very easily and cheaply made, as it can be done by striking up the metal after the pen blank is cut out.
This invention has been patented in all the principal European countries as well as in the United States.
For further information relative thereto, apply to Mr. H Hewitt, 100 Charlotte Street, Birmingham, England.

## GEOGRAPHICAL PUZZLES AND GAMES.

The system consists in teaching geography by means of peculiarly constructed maps, in counection with small wooden blocks upon the sides of which are printed the names and concise descriptions of capitals, cities, States, Territories, countries, etc. These blocks are constructed separately from the maps, but are made of suitable form and size to fit into holes or cavities in the faces of the maps, which holes are always made, in case of territorial divisions, within their limits, and in case of cities, etc., adjacent to marks which indicate the location of the place whose name and description are printed on the sides of the block.
When in use the map is spread upon a table, and the blocks inserted one by one in the holes where they properly the holes where they properly
belong. The operation of belong. The operation of
properly placing them forms a puzzle highly interesting and at the same time very instructive. A comparatively few repetitions of the effort suffices to render a child familiar with the names, location, and characteristics of all the places represented by the

## blocks.

The apparatus is made in series or sets of three parts each, each part consisting of a map and its appropriate blocks. Part No. 1 of the first


NORRIS'S GEOGRAPHICAL PUZZLE AND GAMES.-Fig. 2. series consists of map No. 1 and ninety-seven blocks, each block relating to one city. |tween the temperatures of $100^{\circ}$ and $212^{\circ}$ Fabrenbeit or

The mapis an outline one of the United States, with the names of the States and Territories, principal mountains, lakes, rivers, oceans, gulfs, and bays printed upon its face. The location of capitals and important commercial centers is indicated by appropriate circular marks, adjacent to which are the holes for the reception of the blocks which bear the name and description of the places. Map No. 2 of series No. 1 is wholly an outline map, having no names of any kind printed upon its surface. Names and descriptions of all States, Territories, principal cities, and towns, rivers, lakes, bays, gulfs, oceans, mountains, caves, national parks, oil, coal, gold, and silver mining districts, etc., are printed upon the little wooden blocks, which number over two hundred and fifty.
Map No. 3 of the 1st series has the same number of holes for blocks, but has all names printed on the map, while the blocks carry descriptive matter only, thus making it necessary to place the blocks with no guide to their proper places except the relation the descriptive matter bears to some name upon the map. Maps and appropriate blocks for each issued on the same plan. The apparatus is constructed in special forms and sizefor use in kindergartens, in schools, and in the home circle.
Placing the little wooden blocks in their proper places in the maps forms a very interesting puzzle for a child working by itself. Two or more children may simultaneously work at it with the same map and blocks, and same map and blocks,
then they find themselves engaged in an interesting game wherein each is stimulated to excel the other in the number of blocks properly placed. When all blocks are in, and those placed by each are counted, the one having the larger number of correct locations is declared the winner of the game.
The puzzle or game plan The puzzle or game plan
may be pursued with equal may be pursued with equal
advantage in school room and in the family circle.
Of the accompanying cuts, No. 1 represents the apparatus in use in a school room. Cut No. 2 shows the apparatus as made for use in the thereabout (the fraction known as spirit or naphtha), and treat the same as follows: To every 100 gallons of petroleum add from two to three gallons of sulphuric acid with constant agitation, continued as long as may be necessary in a suitable vessel; it is then allowed to subside, and the liquor


Fig. 3.
decanted from the sediment is run into a still with from one to two per cent or its weight of lime or other dehydrating medium, calcium carbonate, or otber alkaline carbonates, or oxides of metals capable of removing or destroying any sul-pho-oils which may have been generated by the treatment
$\qquad$


\section*{NORRIS'S GEOGRAPHICAL PUZZLE AND GAMES.-Fig. 1.} home circle. Cut No. 3 is a | Any one desiring further information may get it by address- | with sulphuric acid. The distillation is conducted without |
| :--- | :--- | :--- |
| ing the author of the system and manufacturer of the appa- | injecting steam or water into the contents of the still. Be- | ing the author of the system and manufacturer of the appa-

ratus, William R. Norris, at 894 Sixth Avenue, New York.
fore distilling they sometimes submit the liquid to repeated treatment with fresh sulphuric acid until the acid ceases to be colored, or nearly so. As the distillate comes over, the receivers are exchanged as soon as the product which is coming over seaches a specific gravity from about 680 to 690, water being taken as 1,000 . By these processes the portions of petroleum unsuited for a substitute for bisulphide of carbon are removed.

## Solder for Aluminum

Col. Wm. Frishmuth, of Philadelphia, Pa., says: The following receipts to solder aluminum bave been tried by me and found practical. Take 10 parts silver, 10 parts copper, 20 parts aluminum, 60 parts tin, 30 parts zinc. The above solder is excellent for chains, etc., and can be used for the blowpipe operations. For a solder with the common solder iron, take etther 95 parts of tin, 5 parts of bismuth; or 97 parts of tin and 3 parts of bismuth; or 98 parts of tin and 2 parts of bismuth; also 99 parts of tin and 1 part of bismuth; the fuse to use in all cases is either paraffine, stearine, vase line, balsam copaiba, benzine. Articles so soldered must be cleaned well before soldering, and the parts to be soldered must be heated to just enough to make solder adhere to the parts to be soldered. These alloys of solders, as above stated, can be changed to suit the operator.

## POLE LADDER.

Pivoted to the lower end of the pole is a segmentally curved base piece, the concave edge of which faces downward; this permits of the ladder being inclined toward the object against which it rests. Projecting from the pole are out wardly inclined rings arranged alternately on opposite sides of the pole. On the upper end of the pole is a prong, D , that may be driven into the object against which the end of the ladder rests; but the main object of the prong is to aid in climbing the sides of a building, and to hook over a limb of a tree, which the pin just reaches, to support the ladder while picking the fruit. The curved base piece at all


## JAYNE'S POLE LADDER.

times adjusts itseif to the formation of the ground, giving the ladder a good, firm bearing.
This invention has been patented by Mr. John Jayne, of Forkston, Pa.

## Post Mortem Diffusion of Arsenic

Drs. Vaughan and Dawson, of the University of Michi gan, have recently conducted some important experiments with the view of ascertaining if arsenious acid injected into the mouth or rectum after death would diffuse through the body. These observers not only found that such was the case, but that the diffusion was very extensive. The results of their investigations have, says the Lancet, a very important bearing on the question of arsenical poisoning. In the first place, it can no longer be contended that, because arsenic is found in quantity in the fluids and tissues of the body, therefore death was due to its administration; and in the second, a certain amount of immunity is given to the wouldbe murderer, inasmuch as there is the possibility of covering a homicidal act by using arsenic with the ostensible purpose of preserving or embalming the body. We say possibility, for such a procedure would almost to a certainty be defeated in its aim. At any rate, there would be no chance of success if the post mortem examination were conducted within a short time of death, when there would be the usual signs of inflammatory action in the alimentary canal; and again, in the face of other circumstantial evidence, the fact of the accused having resorted to such a particular mode of preserving the body would rather tend to confirm suspicion than to remove it.
Tbat arsenic contained in soil may be dissolved in water and conveyed into the body has long been known. The researches of Drs. Vaughan and Dawson show what appears a priori as probable. During decomposition the relative humidity of different parts of the body, and of these with surrounding media, is constantly changing. Interstitial currents are passing through the tissues by osmotic action, and this liquid diffusion is naturally increased by the presence of crystalloid substances in solution; nor does it cease until the dialysis ends in an equilibrium of attraction which one fluid has for another, or presumably until post mortem disintegration is complete.

## AN IMPROVED LOCOMOTIVE.

The accompanying illustrations represent a locomotive recently patented by Mr. Gabriel Fretel, of Porto Real Province de Rio Janeiro, Brazil, designed to be used on rail roads having steep grades aud sharp curves. The connecting rods are provided with devices for automatically lengthening or shortening them when the locomotive runs on curves hus permitting of coupling a considerable number of driv ing wheels; this is accomplished by boxes mounted on the crank pins of the middle wheels of each frame, which are adapted to slide in the direction of the length of the pins. Fig. 1 is a perspective view of a locomotive embodying these rinciples; Fig. 2 is a plan view of the joint; and Fig: 3 is a plan view of the locomotive supporting frame and the truck frames.
The platforms of the locomotive and tender (the latter is not shown in the engravings) are supplied with pivots, $V^{\prime}$, for supporting them on four frames, $A$, in the middle of which the pivots are arranged. These frames are supported by pivots on trucks formed of the platform, B, supported by springs from the axle boxes. On the bottom of the box is a frame, $\mathrm{B}^{2}$, in which are journaled the shafts carrying the small guide wheels, $E$, the load being so distributed as to rest entirely on the axle, C, and not on the guide wheels. The axle under each pivot is provided with fixed wheels, and is so arranged that it can slide laterally in its bearings. The cylinders are united by connectıng rods, $L$, with the crank pins, $L^{\prime}$, on those wheels that are mounted on the axles between the wheels under the pivots, $\mathrm{V}^{\prime}$, so that motion is transmitted by rigid

2.


## FRETEL'S IMPROVED LOCOMOTIVE.

is then transmitted to the other wheels by extensible frighten the rats. Having but one means of escape, they connecting rods. The automatic lengthening and shortening rush into the pipe and down into the sack. This correspondof the connecting rods can be accomplished in various ways, ent caught twenty-seven rats the first time he tried his trap. one of which is shown in Fig.s. 2 and 3. A sleeve, G, Fig. 2 , is mounted on the crank piu in such a way that the pin can revolve within the sleeve, on which are triangular frames, H , on diametrically opposite sides. The sbank, J, of the frame passes through a diagonal slot in the sliding block, B, sliding longitudinally in a box, E, mounted loosely on the sleeve and which slides in the direction of the length of the sleeve. The box is formed with slots, D, through which the diagonal shank of the frame passes. The connecting bars, $\mathbf{A}$, are pivoted to the sliding blocks, and the outer ends of the boxes are pivoted by ball and socket joints to the bent ends of the shafts, U, Fig. 3.
When the locomotive runs on a curve the wheels will be about in the position shown in Fig. 3; the wheels of each platform remaining on the track in the usual manner, but the middle axle slides outward toward the rail having the longer radius. Looking at the locomotive from the front, the right hand connecting rod, M, Fig. 3, extending from the front to the rear wheels, will h
left hand rod will have to be shortened. As the axle moves to the right in relation to the platform, the sleeves and their frames will move in the same direction. In the right hand wheel the inclined arms of the frames press against the sides of the slots in the sliding boxes aud move them toward the ends of the frames, which, turning on the ball and socket joints, lengthens the right hand connecting rod. At the left hand end of the axle the frame, acting on opposite sides of the grooves, will draw the sliding blocks toward the middle,
necting rod. We have not space to describe in detail the other methods by which these results may be accomplished. The locomotive can be built with a single platform, or with two or more platforms pivoted to each other, and the platforms can be made of greater or lesslength, according to the curves on the road. By coupling several driving wheels the traction is increased-a point of great importance in locomotives running on mountain railways.

South of Long Island, beneath the Atlantic, are the rem nants of a vast marsh. In clear water roots of trees can be een from a boat, and in stormy weather masses of decayed wood and peat are thrown upon the shore.
speaking between New York and Boston.
For some time past the American Bell Telephone Company, in connection with the Southern New England Tele Phone Company and the Metropolitan Telephone Company, of this city, have engaged in coustructing in as perfect a manner as possible an experimental telephone line between this city and Boston, a distance of 225 miles. The experiments, we learn, have been highly successful, so much so that it is said to be easier to talk from New York to Boston on this new line than on the short circuits of the local lines in this city.
The improvement consists in using a metallic wire circuit, the two wires being twisted elose to each other, but separated by an insulating material. Certain improved forms of transmitters are also used. By means of the double wire all extraneous sounds due to induced currents are eliminated, and as a consequence the sound of the voice comes out clear and distinct.


Fig. 3.-FRETEL'S IMPROVED LOCOMOTIVE,

A few days ago Supt. Baker, of the Southern New England Company, at New Haven, Conn., stated that in a very short time the line would be thrown open to public use, and when that was done a person in New York could talk just as easily to his friend in Boston as to any one on the short lines in this city. He had talked to his wife at Stony Creek from New Haven, and they could hear each other just as distinctly as if they were both talking in New Haven.
In view of these improvements, it would seem as if it would be possible at no distant day to put New York in ready telephonic communication with all the principal cities in this country, and the wonder is that such service bas not already been extended.

## Pneumatic Street Railway

There has just been completed at the Risdon Iron Works, San Francisco, an experimental car to be run with compress ed air by a new system, a trial of which was made recently. The subject is one of great interest, more especially as the system will be tried where close comparisons can be made between it and both cable and horse car as to relative economy . In the new plan there is a storage and charging pipe which carries the air below the surface of the road bed all along the route, contiguous to the track. Through a system of valves attached to this pipe, closely set together within the track, the pipe may be tapped and the receivers replenished at any and all points on the route. In this way the system is so arranged that the car is never removed from its source of supply, and has no determined distance to travel with each charge, so that it may have a minimum capacity as to storage room and pressure of air instead of the maximum, as when the length of the journey to the charge is absolute and fixed.
Compressed air motors have been run a definite distance without replenishing, as from end to end of a route and back, and suggestions have been made to run from station to station, using a pipe connection between, but in all cases provision has had to be made for carrying the heaviest possible load of passengers under the most adverse circum stances likely to occur, such as those arising from very frequent stoppages, bad condition of the track, accidental delays, etc. The definite points could not be passed without refilling the receivers, and either the engineer had to go or the motor itself bad to be taken to the station off from the main line in the act of refilling, this system of operation leading to all the difficulties which have beretofore surrounded the use of compressed air as a motive power for street roads. No practical system has been put in use so far by which the motor could be resupplied with air at any and all points on the route
The motor which has just been tried is constructed as an open car, after the style of the cable road dummies, and the air receivers are placed under the seats. From these receivers, which are connected by a pipe, a hose connection is made which terminates in a metal nozzle, in the end of which is fitted a valve to make connection with the service pipe, as described hercafter.
The main service pipe is placed underground, near the track, and is large enough to have in itself storage capacity sufficient to insure that the drawing off of each charge for the motors will not greatly decrease the pressure. It is thought that a pipe of five or six inches diameter will do for roads running cars five minutes apart, while it should never be less than four inches in diameter.
This main pipe is provided with right angled branches, say every 300 feet more or less, which lead to the center of the track and terminate in valvular outlets. The nozzle connected with the reservoir on the cars fits into this valvular outlet, so that air comes from the main pipe into the reservoirs when wanted. The valvular connection is peculiar and the action is automatic. When the nozzle is put in, the air can flow; when withdrawn, the valve in the outlet closes. This is an important feature, and the details are quite ingenious. Of course other devices than this may be used. but a practical trial has demonstrated the utility of the plan adopted. It may be desirable, too, to place reservoirs at the outlets so a great volume of air may be immediately at hand to draw from, and a quick operation in replenishing the receivers affected. Air compressors may be placed at one end of the line only, or at both ends, as circumstances dictate. The air engines connect in the ordinary manner with the driving wheels on the cars.
The system of operating is as follows: The storage and supply pipe being filled with air, say at a pressure of 100 pounds per inch, the motor's receivers are filled therefrom at the depot at full pressure. On starting out as it proceeds on its trip, the air is used on the motors either at full pres sure direct from the recelvers or reduced to say 30 pounds by passing it through reducing valves. It is expected that the new cars can run on the Howard and Mission Street routes,
where they are expected to be placed, at a pressure of 30 where they are expected to be placed, at a pressure of 30
pounds, but this can be increased at will by means of suitapounds, but this can be increased at will by means of suita-
ble mechanism. When the conductor strikes the bell for a passenger to get on or off, the engincer stops at just where the next valve of the suppiy pipe is located or within a few feet thereof. These valves are placed at street crossings generally. The engineer then takes down his feeding nozzle and inserts it into the bole in the street, and convects. The air rushes through the nozzle and fills the reservoirs until the bell sounds to start, when the nozzle is taken up and replaced on its stand. The engineer need not wait to get the first few pounds of pressure, but may start with such pressure as he has obtained. In this way no unnecessary delay occurs.
The car or motor need not be required to travel over six or eight blocks, or even a less distance, where stops are frequent. The valves may be placed at crossings or even every hundred feet if necessary. It is desirable to be able to refill the receiver at every stop, to have great pressure when starting. Several suggestions lave been made to operate street railroads with compressed air carried wear the track, bu none have included within their scope the system here pro-
posed, which is the invention of Mr. George Pardy of this city. In this system the maximum weight of the load and contingencies of the trip do not control, but have only the effect of limiting the distance the motor will be capable of traveling without baving recourse to the supply pipe, con-
stantly at hand. In fact, those stoppages which are of necessity caused by taking or leaving passengers are the only ones necessary to make, it being calculated that these will be ample in most cases to give the required opportunity to eplenish the receiver.
In running on this system they get over the great loss of power required to move a cable. On the cable roads 68 per cent of the power is necessary to drive cable alone withou counting cars or passengers. Then again it is different from steam dummies or locomotives in this: there is only one central fire for the compressing machinery, instead of separate fires, boilers, etc., for each machine. They expect to utilize 50 per cent of the useful effect of the compressed air. One engine supplies all the cars. These cars are expected to go up a grade of one in fifteen.

The experimental trial of the system already made proved very satisfactory to the promoters. The car ran with 100 pounds pressure for three-quarters of a mile one trip, and seven-eighths of a mile the second trip. The car weighed about $31 / 2$ tons and the passengers $21 / 2$ tons. The highest speed attained was 16 miles per hour, and the car went up a grade of one in thirty-seven at 8 miles per hour. The connecting valve worked satisfactorily. It is probable thal this system will be adopted by the Howard and Mission Street car lines. - Min. and Sci. Press.

## Gelatino-Chloride of Silver Emulsion.

Although somewhat slower than a bromide emulsion, the chloride possesses greater scope for positive printing than can be attained with the bromide
Mr. A. L. Henderson, of London, England, recently handed us the following formula for a chloride emulsion, which, judging from the specimen pictures, is very practical and useful:


Water..
The gelatine and silver are dissolved separately, then mixed the silver solution being warmed and gently pouredinto the gelatine.
To this is next added (stirring the silver solution all the time):

## Dry sodium chloride.... ... .... ........................ 21 grains. Potassium citrate........................... <br> Potassium citrate................................... 1 1/ drachm.

## hich is warmed.

The emulsion is poured into a dish and allowed to set.
The jelly-like emulsion is now cut into strips and washed in the usual way; cold water should be used, as the emulsion is very thin. The wash should be carried on under a yellow light.

After washing, the emulsion is melted by heat, and to it are added:

Salicylic acid....................................................... 2 grains.
Dissolved in alcohol.... ................. Also-
Chrome alum .
.. 1 grain.
Dissolved in a small quantity of warm water
After the emulsion is filtered the plates are coated with it in the usual way. The film is extremely thin, on account of the watery composition of the emulsion. If more contras is wanted, the emulsion should be made thicker by the addition of gelatine.
As it will not keep well, only small batches should be made at a time, enough to cover the plates to be coated.
Opal plates coated with the emulsion are printed behind a negative in a frame in the same manner as with ordinary silver paper; the picture will appear on the surface in the same way. The exposure varies with the density of the negative, and may readily be ascertained by exposing a piece of paper coated with the same emulsion behind the negative After printing, the plate is first well washed, and is next toned with the ordinary chloride of gold and borax toning bath; it is again well washed, and fixed for 10 or 15 minutes in a bypo bath of 21 per cent strength; is washed well and soaked again for a few minutes in an alum bath, washed, and dried.

## Wire Rope Transmission for Pumping.

A recent issue of the transactions of the Societe de l'Indus plants Orleans shaft of the Brassac colliery, France. Both are interesting examples of the employment of wire rope transmission for driving underground pumps by surface machin ery. At the Segur shaft the hoisting engine is used for pumping at night, but, especially during siuking, additional pumping is necessary, and this is done in the following way:
An engine on the surface. 130 meters ( 426.5 feet) from the shaft, making 40 revolutions, drives a sheave making 360 revolutions a minute, the speed of the 12 millimeter ( 0.47 inch) rope being 226 meters ( $71 \cdot 4$ feet). The duty is 0.3 cubic meter ( 10.6 cubic feet) of water per minute from a depth of 135 meters ( 442.9 feet). The pumps are two singleacting plunger pumps, 200 millimeters ( $7 \cdot 87$ inches) in di ameter, and 500 millimeters ( 19.7 inches) stroke, making 10.8 strokes a minute, and requiring theoretically 10.5 horse power. The wire rope is kept taut by a sliding counterweight arrangement making a tension of 255 kilogrammes ( $562 \cdot 1$ pounds). The average life of the rope is 1,900 working hours, during which 34,000 cubic meters $(1,200,000$ cubic feet) of water are raised.

At the Orleans shaft the pumps were used to sink from depth of 264 meters ( 866.2 feet) to a depth of 325 meter ( $1,066 \cdot 3$ feet). They were driven by an old horizontal 350 by 1,000 millimeter ( 138 by $39 \cdot 4 \mathrm{inch}$ ) engine, making 60 revo lutions, driving the main sheave from which the rope was conducted into the shaft to two old Letestu pumps, 200 mil limeters in diameter ( $7 \cdot 9$ inches), and with 660 millimeter ( 26 inch) stroke. Making 16 strokes, they were capable of lifting 05 cubic meter ( 17.7 cubic feet) of water. The rope was conducted underground over three sheaves, two of them gearing down to the speed of the pumps, while the third was used for the suspension of the weight to keep the rope taut. The sheave on the surface makes 200 revolutions, and the pump sheaves 312, the speed of the rope being 20 meters the pump sheaves 312 , the speed of the rope being 20 meters
( 656 feet). One rope lasted 73 days, a second 81 days, the ( 656 feet).
total length being 590 meters ( $1,935 \cdot 8$ feet) and its diameter 13 millimeters ( 0.51 inch ). The wear of the ropes in both cases seems excessive.

## Soap for Removing Stains.

It has been for long a great desideratum to obtain an article really possessing the frequently rather contradictory properties and qualities demanded of such an article. Many productions have indeed been well pushed for the purposes in question, but the effective articles are few and far be tween. Only too often the much vaunted "stain soap" consists of nothing else than coconut soap, and does not contain a trace of either ox gall, turpentine, or any other in gredient suitable for increasing the detergent powers of a soap. A favorite trick, according to Moniteur de la Teinture, employed by unscrupulous demonstrators of the efficacy of the article in which they deal, is removing a stain which they make on a piece of cotton cloth with a brush cbarged with gas tar. If, however, the tar used be examined, it will be found that it has been well mixed beforehand with strong acid, and so can be removed almost as well without soap.
A good stain removing soap ought always to smell rather strongly of turpentine or similar compounds. In the glove cleaning trade the quality of the soap specially prepared is of the highest importance, and much attention is paid to this article by careful operators. There is no reason whatever why a special article for removing accidental stains, which do occasionally occur in even the best managed works, should not be prepared in every bleach, dye, and print works, especially as there is often the necessary skilled chemical superintendence ready at hand in the person of the works' chemist. We give the two best formulæ known, with full directions for preparing the soap satisfactorily. Take 22 pounds of the best white soan and reduce it to thin shavings. Place it in a boiler, together with

Water.
Ox gall.
$13: 25 \mathrm{lb}$.
Cover up and allow to remain at rest all night. In the morning Leat up gently, and regulate it so that the soap may dissolve without stirring. When the whole is homogeneous and flows smoothly, part of the water having been vaporized, add

Turpentine............... ......... ................. .... ...... 0.55 lb .
and mix well. While still in the state of fusion color with green ultramarine, and ammonia, pour into moulds, and stand fora few days before using. The product will be found to act admirably, and the yield is very good indeed The second method we shall give is rather more difficult to carry out than the former one, as it requires a little skill in soap boiling to prevent the soap coming out unevenly on stirring, and the introduction of the ox gall requires to be done carefully. Take of


Melt the fat, add the stone and color, cool to $20^{\circ} \mathrm{C}$., and then add the solution of soda. When all is well united and mixed, add very gradually the gall, continuing the agitation without stopping for some time after all has been added. Should any separation take place, cover the boiler up for a few seconds, and if this does not help, fire up again, and continue stirring. Lastly, add the turpentine and benzine. Pour into moulds, and stand before using. This preparation, when properly applied with a brush, will remove the most refractory stains without injury to the cloth.

## Coral Fishing

Coral fishing is largely followed in Algeria, 40,000 to 45,000 pounds of coral, valued at about $£ 38,000$, being the yearly production; La Calle is the center of this industry, and there are employed annually 160 boats and 1,300 men. The coral is obtained by means of a wooden apparatus in the shape of a cross, having in its center a leaden slug or stone for ballast. Nets, the meshes of which are loose, are hung on the bars of the cross and dragged at the bottom of the sea, and among the nooks and crevices of the rocks. These nets, winding about the coraline plant, break up or tear off its branches, which adbere to the meshes. The apparatus is drawn up by the fisherman whenever he thinks it sufficiently laden. There is also a net which is provided with large iron nails, having thus great force to break the coral, but this apparatus is forbidden to be used.

## Correxymaleucr.

## Working Surveyor's Problems.

To the Editor of the Scientific American:
Being recently called to survey a field, the problem was to bisect a quadrilateral from a point given on one side. Robinson solves this by prolonging the sides $a b$ and $c d$ to their intersection at $x$, thence by similar triangles. Loomis and Davis give a "cut and try" method, as in the figure, set a trial stake at $n$, compute $c a o n$, then add or subtract by triangle. The tirst method goes outside the figure, and for proof by literal measurement would carry the chain over too many fields to the point $x$. To guess at a point, as by trial stake at $n$, necessitates a long computation. The method given is very simple, and would suggest itself to many minds, and yet I have not seen it published. It is a positive method without a trial stake, and does not lead outside the figure.
The circumstances were: Two men had purchased twenty acres in partnership; on dissolution, the land was divided leaving each an equal front on the road. In $a b d c$ sides, and angles at $c a b d$ given, to draw a line to $c d$,

from the point $o$, bisecting the figure. Draw and compute $c o$ and $a P$, let fall from $a$, perpendicular on $c o$; then compute $c a o$, and subtract it from ten acres, leaving area of $c o$ s. Draw and compute $o z$, let fall from $o$, perpendicular on $c s$, then area of $c o s$ divided by one-balf $o z$ gives $c s$ and the point $s$. Join 0 s, and it will be the line which bisects $a b d$ from the point $o$.
Being called to measure accurately an air line across chasm of 126 feet for an iron bridge, and being without a steel tape the first day, I placed two new steel squares end to end along a wooden rod for sixteen feet with a microscope, and with this measured a steel wire laid and stretched straight on a level surface of boards, then stretcbing the wire across from $a$ to $b$. I was at a loss to know how much to allow for the shortening of the wire caused by the sagging at $d$. Returning to the level surface, I stretched and mea sured the wire again, marking the position of the ends on the surface. Then releasing one end and allowing the wire to hang slack, I stretched it unsupported along its course a the side of the board surface, and found that when taut, and

with a depression of two inches at the middle, the shorten ing was less than one-quarter of an inch for the entire length. Equal tension in stretching was tested by the pitch of the taut wire. On obtaining a 100 foot steel tape immediately by express, the steel squares and pole bad given a result with a total error of less than one inch for the entire length
On accepting the work I had asked and obtained permission for a poseible error of two inches until I should obtain more accurate instruments.
I would like to hear from others on these or other similar problems. What is the method used in obtaining air line distances, as at the piers of the cantilever bridge at Niagara, and with what result?
E. D. Vance.

Kinsman, Obio, May, 1884.

## Summer Diet.

Two gond rules in diet, good in summer or winter, and at all times-apparently trite, because so often repeated, but still alive and useful while men live and have stomachsmay be thus stated: Rule first is, as the Ledger has often repeated, "The rule of not too much." In the languor of summer one is tempted to the use of stimulants more or less hurtful, but, all to be included under the general term of "irritants." These create a factitious lappetite, which demands an oversupply of food, and leaves the eater no better off, so far as comtort is considered, than he was before eating. If you don't wish to eat, take care to eat but little, and that of the most digestible food, till the desire comes naturally. Just take enough to support nature, and good digestion will provide an appetite for the coming meal times.

Rule second is, the rule of not too mixed. Everybody has smiled at the story of the innocent young person to whom a seltzer, powder was prescribed, and who dissolved the separate components in separate glasses and swallowed first one and then the other. Astonishment and rebellion arose in his stomach at the entrance of two such uncongenial visitors. The truth is, however, that this experiment is very often
dangerous form. People swallow, without thinking, and often without knowing, incompatible and warring articles of food or of refreshment at the same meal, and thus turn their stomachs into chemical laboratories or fermenting tauks. Such experiments are sure to make disturbance and various internal commotions, disagreeable and perilous in their very nature. It should need no chemical analysis to tell us this; experience should be enough.-Phil. Ledger.

## Boiler Efficiency.

When leading men speak of the steam engine wasting nine-tenths of the heat energy supplied to it, they should guard against misconception by admitting from the first that a steam engine cannot be said to waste that heat which it must give up in consequence not of its own defects, but in consequence of inherent defects in steam considered as a gas. Again, it is necessary to be more exact when dealing with this question as far as it relates to the boiler as a heat engive. The examples wherewithal to point a diatribe on the performances of a well tried apparatus should be from its best work and not from a general average, which includes the very bad performance of the indifferently constructed examples of that apparatus. For instance, it is not true that at the very outset of our operations toward the use of heat in a steam engine we throw a way twice as much heat as we succeed in utilizing in the steam engine. There are what we call losses which are as inevitable as is the loss of energy due to the necessity for using, say, a lever or a wheelbarrow which has weight, because one without it does not exist, and a steam engine or a boiler works under these abstract disadvantages; they cannot be called practical dis advantages; because the practice cannot be realized unde other conditions; nor theoretical disadvantages, because rea theory takes into consideration all practical conditions.
We may see what a moderately good boiler does with pound of coal. The heat of combustion of 1 pound of pure carbon burned to carbonic acid is 14,544 units, and will re quire for its combustion $2 \cdot 666$ pounds of oxygen. As we are not dealing with calorime ter experiments, we will as sume that the oxygen is obtained from atmospheric air. Of this $12 \cdot 2$ pounds will provide the oxygen required. We shall then have $12 \cdot 2+1=13 \cdot 2$ pounds of gases heated by the 14,54 units, and shall therefore have as the highest possible temperature with air at 60 deg ., and having a specific heat of 0238 , of $T=(460+60)+\quad 14,544$
assume that the heat of the escaping gases could be so fa utilized as to fall to that of the feed water, or say 100 deg or 560 absolute, we should then have as the greatest possi ble proportion of available heat, or heat which could unde the most favorable and bitherto impracticable conditions be 5150-560
realized, only $\frac{5150}{5150}=0.891$; that is to say, with an abso
lutely perfect boiler, burning pure carbonfor carbonic acid, with air at 60 deg. Fah., and only enough to provide the oxygen necessary for chemical combination, there must be a loss of 11 per cent. But this is not waste. Now to fol low this up, to see how far a good steam boiler deserves the character for wastefulness which it is so common to ascribe to it, we must take more numerical values. We must make out the worst case for the boiler, and so must credit the fuel with all it possesses in the form of heat. We bave supposed the air to be at 60 deg . Fah., and must take the same temperature for the 1 pound of carbon, or an absolute temperature of 520 deg . The specific heat of carbon being 0.25 , it must be credited with $1 \times 0.25 \times 520=130$ units; the air must be credited with $1.2 .2 \times 0.238 \times 520=1,485$ units, and these quantities with the heat developed in combustion $=16,159$ units, from which, however, must be de ducted 32 units as the equivalent of the work done in dis placing atmospheric air by products of combustion raised from 60 deg. to 100 deg., at which they are supposed to es cape, or increased in volume from $149 \cdot 8$ cubic feet to $161 \cdot 3$ cubic feet, which leaves us 16,127 units as the total quantity of beat available. This is sufficient to evaporate 16.69 pounds of water from and at 212 deg., but as the greates possible quantity of the total heat realizable is 0.891 , a above shown, the greatest possible evaporation from and at 212 deg . by 1 pound of carbon, the beat required to evapo rate 1 pound of water at this temperature being 966 units,
is $\mathbf{1 6 , 1 5 9 \times 0 . 8 9 1 - 3 2}$
966
Now what do we get, as compared with this, from a good boiler? Following Mr. W. Anderson's excellent lecture, deivered before the Institution of Civil Engineers last Decemer', we may refer to the results obtained in the portable en gine trials made under the Royal Agricultural Society, at Cardiff, in 1872, with a portable engine boiler, nominally of 3 horse power. To begin with, the coal used was not, of course, all carbon. It was a smokeless Welsh coal, containing 0.8497 pound of carbon per pound; but it contained 0.0426 pound of hydrogen, and as the heat developed in the combustion of 1 pound of bydrogen is 4.265 times as mucb as by 1 pound of carbou, we have to take this into our calculation; and inasmuch as the coal also contained 0.035 pound of oxygen in combination with hydrogen, in the form of water, and will abstract its combining equivalent of hydrogen from the fuel, one-eighth of the weight of the hydrogen must be deducted. Thus, as the 14,544 units developed in the combustion of 1 pound of carbon are equivalent
to 15.06 pounds of water evaporated at 212 deg. we have
or 1 pound of the above coal, the heat expressed in pound

$$
=15.06\left\{0.8497+4.26\left(0.0426=\frac{0.035}{8}\right)\right\}=15
$$

pounds of water from and at 212 deg., equivalent to $14,2 \%$ units of heat.
The conditions of combustion in the furnace of a steam boiler being so different from those in a calorimeter, the quantity of air used vastly exceeds that used in the labora tory as represented by oxygen; and in the boiler we are now tory as represented by oxygen; and in the boiler we are now
dealing with, 50 per cent more air was admitted than would be necessary to supply theoretically the oxygen required for perfect combustion. This makes 18 pounds-about 2 pounds is more commonly, used-of air per pound of coal, and consequently 19 pounds of gases would have to be heated by the 14,727 units available, and hence the maximum temperature obtainable above that of the atmosphere would be 14,727

## $\overline{19 \times 0.238}$

The temperature of the smoke from this boiler was 849 deg absolute, and hence the maximum duty of the obtainable beat would be $\underline{3,777 \text { deg. }-849 \mathrm{deg} .}$

3,749 deg.
The specific heat of coal is about the same as that of gases at constant pressure, or as above given, and hence. the temperature of the air being 60 deg., the 18 pounds of ir and 1 pound of coal took to the furnace 19 pounds $\times$ $520 \times 0238=2,350$ units, which, with the heat of combus tion $=14,727$ units, gives a total of 17,078 units, from which must be deducted 422 units for the heat expended in dis placing atmosphere, or 151 cubic feet, which leaves us, as the total available energy of the 1 pound of coal, 16,656 units. The greatest possible quantity of work to be obtain ed from such a boiler would, then, be
$17,078 \times\left(\frac{3,777-849}{3,777}\right)-422$
966
rated from and at 212 deg., or equal to 12,819 units. Now he boiler actually evaporated 11.83 pounds of water pe pound of coal, and hence the efficiency of this boiler was 11.83 $\frac{13 \cdot 27}{}=0.892$, or less than 11 per cent below the greatest possible efficiency under perfect conditions.
The portable engine or locomotive type of steam boiler is thus very far from being the inefficient thing which on incomplete bases of calculation it is often said to be, and there is not after all a great deal of room for that increase in efficiency to which it is sometimes asserted we ought in some way to attain. It may certainly be said that the reproaches referred to by our correspondent are not deserved by good boilers, nor are the results obtainable by their use so very miserable. It may be necessary to remark that we are referring to good and not to cheap and bad boilers. The Engineer.

Mr. G. M. Shaw, of this city, has just returned from a month's trip to the Gila River country in the southwestern portion of Socorro County, where he went with Messrs. Brown and Bergen to survey and report on the recent alum discoveries there, which bave been located by a company of Socorro citizens.
Mr. Shaw reports almost a solid mountain of alum over a mile square, some of the cliffs of which rise to an elevation f 700 feet above the river bed. Most of the alum is in au impure state and tasting very strongly of sulphuric acid but of which there seems to be an inexhaustible quansity Some of the cliffs, however, show immense quantities of almost pure marketable alum. This alum find, Mr. Sbaw tells us, is on the Gila River about two miles below the fork of the Little Gila and four miles below the Gila hot springs.
Mr. Shaw reports numerous hot springs in that section, most of them gushing out of the rocks that form the river banks, some of them hot enough to cook in, and most of them too hot to hold the hand in. The main hot springs re ferred to above are reported to have effected wonderful rbeumatic and other cures. The country is abundantly watered and wooded, and is covered with the finest of grass: The Gila is full of trout and other fisth. Game, while still moderately plentiful, has been mostly scared a way from the region of the hot springs by professional and other huuters, as well as ranchmen, who are beginning to locate in this difficult-to-get-at section of the Gila. At present the only way to get into this section is with pack animals over a pre cipitous trail of several miles, wagons having to be abandoned in the gorge of the Little Gila on the North Sta Road, about two miles from the hot springs and about seven miles from the alum find, going from Socorro or from the Black range. By the way of Silver City and Georgetowi wagons are abandoned on "Sapio" Creek, with about eighteen miles of pack animal trail to the hot springs.
Mr. Shaw being an amateur photographer, also, invaria bly carries bis "outfit" along on his surveying trips, combining pleasure with business, and bringing back with him photographs of all objects and scenes of interest that he meets with on the way. He brings back from this trip over sixty photographs of the Gila country, among which are a number of exterior and interior photographs of some interesting cliff-dwellers' ruins he encountered in a cave about four miles west from the hot springs.-Socorro Budion.

## THE GREINDL PUMP.

In establishing the Greindl pump, the inventor has had in view the great excess of driving power over useful work done required by most pumps in use, arising from two principal causes:
1st. The inertia of the water, or the difficulty of putting it into motion again after it has been brought to a rest, and the consequent reduction of the effective pressure. 2d. The necessity of imparting at certain moments a high velocity to a considerable mass of water, the production of this velocity requiring the expenditure of a great amount of power, of which only a small portion is given out again as useful effect.

It is clear that if these two sources of difficulty are got rid of, a near approach is made to perfect efficiency, that is, to an equality between the theoretical driving power required and that which is utilized in the work done. Thus the invention of the Greindl pump bas had its origin in carefully worked and theoretical considerations.
The pump consists of a chamber within which work two


## the greindl pump.

cylindrical drums, $A$ and $B$, of equal diameter, running in contact with each other on parallel shafts. One of these drums, A, carries two radial vanes or blades acting as pistons, which as they revolve enter alternately into a recess of epicycloidal section extending along the whole length of the other drum, B. The shafts of the drums are geared, so that the recessed drum, B, makes two revolutions to one of the bladed drum, A, thereby enabling the single recess in the quick drum to serve for the two blades on the slower. The inlet and outlet passages are arranged in such a manner as to present everywhere the same sectional area throughout the entire course of the water, in order not to impede its movement in any way during its passage througb the pump. In consequence of the continuous motion of the stream of water, any foreign solid substance can pass through the pump without occasioning either a stoppage or a breakage. The blades of the slower drum strike the water without any perceptible shock. Lateral pockets in the end cover plates afford ample space for the water to escape through at the moment when the space left between the blade and the recess threatens to be insufficient for that purpose.
As there are no springs, no leathers, and no packings of any description to cause friction, the wear is reduced to a minimum, and thereby also the driving power. The pump is, moreover; one of the simplest and least expensive to the pump is not at all liable to get out of order; a pump de


## THE GREINDL PUMP

livering 550 gallons per minute runs at only 140 revolutions per minute of the bladed drum.

Contrary to what is the case with centrifugal pumps which cannot draw air, the Greindl pump can draw gases and discharge them as effectually as liquids. It can thus in sugar refineries take the place of air pumps with valves for the boiling and evaporating apparatus, and even of carbonic acid gas blowers. It is also used to elevate molasses and juices having the consistency of paper paste, and it is fast becoming in general use in all branches of industry where a reliable pump is required.
This pump is patented in the United States, and further
information will be furnished by Mr. E. Feirand, Detroit, Mich., attorney for Mr. L. Poillon, the owner of the patents.

## A Wonderful Substance.

Among the most interesting developments which have folowed in the wake of the discovery of petroleum is the immense trade which has sprung up in ozokerite, or ozocerite s Webster has it. No fairer substance ever sprang from most unpromising parentage than the snowy, pure, tasteless, opalescent wax which is evolved from the loud smelling, pitchy dregs of the petroleum still. The Mining Review thus sums up the many uses 10 which this remarkable substance is applied: This comely, impressionable article, with all its mooth, soft beauty, defies agents which can destroy the pecious metals aud eat up the har por more effect on ozokerite than spring water. It is alike impervious to acid and to moisture. Its advent seems to have been a special dispensation in this age of electricity.
Every overhead electric light cable or underground con duit, or slender wire, cunningly wrapped with cotton thread; all these owe their fitness for conducting the subtle fluid to the presence of this wax. And in still more familiar forms let us outline the utility of this substance. Every gushing school girl who sinks her white teeth into chewing gum chews this paraffine wax. Every caramel she eats contains this wax, and is wrapped in paper saturated with the same substance. The gloss seen upon loundreds of varieties of confectionery is due to the presence of this ingredient of petroleum, used to give the articles a certain consistency, as the laundress uses starch. So that a product taken from the dirtiest, worst-smelling of tars finds its way to the mil lionaire's mansion, an honored servitor. It aids to make possible the electric radiance that floods bis rooms; or, in the form of wax candles, sheds a softer luster over the scene. It polishes the floor for the feet of his guests, and it melts in their mouths in the costliest candies. For the insulation of electric wire, paraffine wax has to-day no successful rival, and the growth of the demand for this pur pose keeps pace with the marvelous growth of the electric lighting system. A single Chicago firm buys paraffine wax by the car load. Its price is but half that of beeswax, and yet the older wax yields readily to sulphuric or other acid, this being a test for the presence of beeswax in paraffine. The demand for paraffine for candles as yet beads the list.

Then comes the needs of the paper consumers. In 1877 a single firm in New York handled 14,000 reams of waxed paper. Not only for wrapping candy is this paper valuable, but fine cutlery, hardware, etc., incased in waxed paper is safe from the encroachment of rust or dampness. Fish and butter and a score of other articles are also thus wrapped, and there seems literally no end to the uses found for the paper saturated with this pure hydrocarbon. In the cbemist's laboratory it is invaluable as a coating for articles exposed to all manner of powerful sissolvents; brewers find it a capital thing for coating the interior of barrels, and the maker of wax flowers simulates uature in sheets of par affine. And yet, until Drake drilled his oil well in 1859, the existence in this country of this boon to civilization was unsuspected, and it lay in the depths of Pennsylvania rocks, where thousands, possibly millions, of years ago it was stored by the hand of an all wise Creator.

## Marvelous Horsemanship.

A St. Petersburg correspondent, writing to the London Standard, says: "This morning I witnessed a wonderfu display of horsemensbip. It took place in the Petroffsky Park. Here, in the presence of the Grand Duke Nicholas, and most of the foreign officers and guests, the regiment of Cossack Guards went through an extraordinary series of exercises which threw the most daring feats of the circus into the shade. The entire regiment passed at full galop, in loose order, with many of the men standing upright in their saddles, others upon their heads with legs in the air, many leaping upon the ground and then into the saddle again at full speed, some springing over their horse's heads and picking up stones from the ground, and yet regaining their seat. While performing these feats all were brandishing their sabers and firing pistols, throwing their carbines into the air and catching them again, and yelling like mani acs. Some men went past in pairs, standing with a leg on each other's horses-one wild fellow carried off another dressed as a woman. The effect of the scene was absolutely be wildering, and it seemed as if the whole regiment had gone mad. Upon a signal being given, the regiment divided into two parts. One rode off; then halted and made their horses lie down on the ground lie beside them, waiting as in war the approach of the enemy. The other section of the regiment then charged down, and in an instant every horse was on his feet, every rider in his saddle, and with a wild yell
they rode at their supposed enemy. When the maneuvers they rode at their supposed enemy. When the maneuvers were over, the regiment rode past, singing, and uncommonly well together, a military chorus. Altogether, it was a marvelous exhibition of daring horsemanship, and one bardly knew whether to admire the docility and mettle of the steeds or the skill and courage of the riders. All the foreign officers and guests were no less astonished than delighted."

## A NOVEL SLED.

The rear section of the seat is fixed to the sled and is about one third of the total length, while the forward section is hinged to the front edge of the rear one. To the under side of the forward section is pivoted an M-shaped brace, at the $V$-shaped portion of which is formed an eye. In front of the brace and projecting from the bottom is a loop. On he rear side of the front crossbar of the sled is fastened a clip, which holds a screw. Rollers, fitting between the runners, are mounted loosely on rods tbat are beld in place by winged nuts screwed on the ends. As the movable sec ion folds down, the brace folds against its under side and the loop passes between the clip and the crossbar, being beld in place by the screw. When the section is raised, as shown in Fig. 1-the end bars of the brace resting upon the crossbar and the eye being held in the clip by the screw-the sled is less dangerous and more convenient than the common ones. The rollers can be easily removed and replaced; but when so provided the sled can be used indoors, on sidewalks, etc. This invention has been patented by Mr. Antonio Carra-


## CARRARA'S NOVEL SLED.

a, and further particulars may be obtained by addressin Mr. A. Girardot, of 35 East Kinney Street, Newark, N. J.

## The Blowing Adder.

The snake known as the blowing adder was formerly common in the meadows of Orange County, N. Y., but is now very rare. It is a beautifully marked snake, growing o three feet in length, and receives its name from its habit of laying its head close to the ground when disturbed and rapidly inflating or spreading it out until the head becomes rapidly inflating or spreading it out until the head becomes
twice its usual size, when the air is blown out of the snake's twice its usual size, when the air is blown out of the snake's
mouth with a uoise like escaping steam. The snake is mouth with a noise like escaping steam. The snake is
said to be poisonous. The first one that has been seen in the county for a long time was discovered by George Spring stead, on July 20 in the town of Wawayauda. He smashed its head with a club, when he was surprised to see a young snake crawl out of the dead oue's mouth. He cut the old snake open and found 75 young ones, four inches long, iuside of it and killed them.

## IMPROVED BUCK SAW.

In an invention lately patented by Mr. Myron Case, of Kasoag, N. Y., there is arranged, in place of the usual middle bar, a combined brace and strainer consisting of a thrust bar, C (Fig. 1), pivoted, near its end, to the lever bar, D, which is pivoted to the end bar, F, and extended diagonally to the upper end of the end bar, E, with which it is connected by a suitable binding device, so as to be shifted along and secured at any point. The bar, $D$, consists of two parallel parts provided with a connecting pin each side of the bar, $\mathbf{E}$, a wedge, I , to hold the bar in any position, being placed between the end bar and pin, H . The bar may be secured by a grip yoke, K, Fig. 2. To take


CASE'S IMPROVED BUCK SAW.
up the slack the bar, C, may be made extensible, with a cam, O, pivoted on one part and bearing against a shoulder on the other part, so that the bar may be extended readily at any time by shifting the cam a little. The cam is set in a slot in one of the sections of the bar, in which slot a bar, M, is located with one end against the face of the cam, the other end heing connected with a pin, P, extending through slots in the sides of the other section.
Between the two parts of the bar, D , is held a block, Q , formed with a concave shoulder in which the bar, $L$, rests. The bar, D, may have a series of holes for shifting the pivot pin, J, along it.

## FIFTY HORSE POWER ENGINE AND BOILER.

We illustrate from the Engineer a semi-fixed engine of un usually large size made by Messrs. Ruston \& Proctor, of Lincoln, to the following specification:

Cylinders.-To be respectively 14 inches diameter for the high pressure and $221 / 2$ inches diameter for the low pressure, the steam passing from the first to the second, and thus expanding to the most economical extent; both to be 24 ivches stroke. The working barrel of each to be cast separately of specially selected hard metal and forced into the main casting, the space between forming the steam jacket, which completely surrounds each cylinder. The slide valves of the same kind of iron scraped up fairly with the valve faces. The steam chests to be placed on each side and the stop valve chamber centrally in front, all the valves being at once accessible on the removal of their respective covers. The cylinders to be planed to receive the channel iron frame and strongly bolted to it ; at the top to be secured by a flange to the boiler. The cylinder covers to be polished, the glands all brass of extra strong pattern, suitable drain and tallow cocks to be provided, and a special arrangement for draining the steam jackets. The barrels to be covered with felt and wood lagging, and finished with neat sheet iron casing fastened by screws.

Pistons.-Of improved pattern, with two metallic packing
branch from the exhaust pipe connected by a copper tube furnished with brass cock, to the "return" pipe of the pump. The overflow water, thus highly heated by the ex haust steam condensing and uniting with it, passes down and raises the temperature of all the water in the feed tank to nearly boiling point.
Crank shaft.-Of steel bent from a single bar, and truly turned, to be long enough to carry a pulley at both ends. Crank shaft carriages.-To be strongly attached to the rame, and very substantial, with extra long gun metal bear ings adjustable both vertically and horizontally, and caps made to fit over projections on the horn blocks.
Flyoheel. -10 feet diameter by 16 inches face, of heavy pattern, turned to carry belt; revolutions per minute, 90 .
Bed plate.-To be formed of two strong channel iron bars firmly braced together at the ends by the cylinder and ashpan castings, and stayed between by the wrought iron plate arrying the guide stands.
Boiler.-Placed over the engine; to be of the loco-multitubular type, very strong, of ample capacity and extra heating surface, suitable for burning wood. The barrel plates to be of best Staffordshire quality; double riveted in longitudinal seams, and arch plate of same quality. The tube plate and other plates of flanging quality.
Fire box.-To have large grate area. All the plates-front
ected by a copper bend with an anti-priming pipe fixed in side the boiler. Combined spring balance lever safety valve and improved lock-up spring safety valve. Steam pressure gauge and brass siphon, glass water gauge of strong pattern, two brass gauge cocks, and signal whistle. Steam jet pipe and cock for forcing the draught. Brass blow-off cock and water plug.
Sundries.-The boiler barrel to be felted, lagged with wood, and neatly covered with sheet iron. The engine to have good lubricators to all bearings; tool box and set of case-hardened spanners; firıng tools and shovel; suction and return pipes; tube brush and rod; water funnel; oil tin and spare gauge glass; also suitable holding-down bolts.
Generally.-To be capable of working up to three times its nominal power, and to be tested under steam by a friction brake; to be made throughout of the very best material and workmanship, every part being finished accurately to gauge by the most modern appliances.

Coal Dust Fuel in France.
The United States Commercial Agent at Nantes says that the coal dust, which was formerly rejected as worthless, is now consumed in immense quantities in France in the form of "patent fuel," or coal bricks. The natural supply of
dust from the yards of the coal merchants being entirely in-


FIFTY HORSE POWER COMPOUND ENGINE AND BOILER.
rings and internal spring ring, to be bored taper and secured by outs to steel piston rods.
Crossheads.-Of hammered scrap iron, forged solid, tool finished all over, and cottered firmly to piston rods.
Slide bars.-To be quadruple, of rectangular section, bolted respectively to the cylinder covers and neat guide stands. Slide blocks of cast iron with large wearing surfaces. Gudgeons of steel, firmly keyed to crossheads.
Connecting rods.-Of best scrap iron finished bright, fitted at both ends with extra long gun metal bushes secured by straps and cotters.
Eccentric straps.-Of gun metal poiished, with bright wrought iron rods and case-hardened joints anu pins. Valve spindles of steel, to work in suitable brass guides.
Automatic gear.-The admission of steam to thehigh pressure cylinder to be automatically varied by the governor from 1 per cent up to 50 per cent of the stroke, according to the power required, by an improved arrangement of gear consisting of a double-ported expansion valve connected by a radius rod to a rocking slot link driven by a separate eccentric.

Governor.-Of improved cross-arm type, very sensitive in action, connected directly to the expansion gear, and furnished with an oil cylinder to steady it.
Feed pump.-Of ample size worked by separate eccentric, with gun metal plunger, valve box and valves and copper delivery pipe; to work continuously, water not required by the boiler being returned through a regulating cock to the feed tank.

Water heater.-Of improved construction, to consist of a
cover and tube plate-to be exclusively of Lowmoor or of Bowling iron, and to be well strengthened by deep girders and screw stays at top and sides respectively.
Tubes.-To be of best wrought iron lap welded, 2 inches extreme diameter, 144 in number; expanded by patent tool at smoke box ends, and secured in the fire box by steel ferrules.

Manhole.-To be formed in a stout wrought iron plate flanged and riveted round the opening, with a strong cover, crossbars, and bolts. Mudboles, suitably furnished, to be made at each corner of fire box, in the smoke box, and in a mud collector placed under the barrel.
Seatings.-Strong cast iron seatings, truly faced, to be riveted on the shell to carry the safety valves and check valve.

Workmanship.-The plate edges to be planed and fullered, rivet holes to be accurately punched fair with each other, and plates be riveted up by patent hydraulic machinery. The stayholes in the firebox to be drilled through both plates at once, so as to be perfectly true.
Pressure.-'Fo be strongly stayed for a working pressure of 120 pounds per square inch, and tested by water to 200 pounds per square inch.

Mountings.-To be furnished as follows: Strong wrought iron smoke box, with door and fittings. Chimney base, and wrought iron chimney finished with bell top and damper plate. Fire door with baffle plate, set of fire bars, and cast iron ash pan with regulating damper. Brass safety plug screwed into crown of fire box. Balanced steam stop valye with starting handle, placed in the cylinder casting, and con-
sufficient for the needs of the brick works, the manufac turers, particularly in the Nantes district, import a large quantity of coal dust from Cardiff, Swansea, and Newport. The process of manufacture is very simple. The coal dust is mixed with pitch, and the mixture poured into cups attached to a belt, each cup containing just enough material for a brick of the size desired. The belt in its movement passes this material through a chamber where it is exposed to steam; which fuses the two substances into a homogeneous mass.
This is poured by the descent of the belt into moulds, where it is subjected to an enormous pressure by a hydraulic press or by machinery set in motion by a steam engine. The brick is square in form, its thickness being about one-third of its other dimensions, and it weighs five, ten, or fifteen pounds. Certain of the French railway companies refuse to accept fuel unless at least 10 per cent of pitch bas been used for its agglomeration. It is stated that briquettes are preferable to ordinary coal for exportation to the colonies and to warm climates on account of their compact storage and freedom from small fragments and dust, also for use on locomotives, both on account of economy of space aud be cause firemen can always determine the amount of fuel they are employing in a given time, the weight of each brick being exactly known. The manufacturers claim that the "patent fuel" is more healthy for domestic use than ordinary coal, citing in support of this theory the declaration of certain well known physicians. At the present day a large number of bricks are made for domestic use, of small size and perforated with circular or longitudinal openings.

A NURSE THAT WILL NEVER BE CARELESS. An English inventor has patented what is described as a "thermostatic nurse." Nursemaids may think this a rather high sounding name, and possibly some will feel it an imputation on therr class, but the title very well expresses the character of the invention. It is an artificially warmed and thoroughly ventilated box, in which a crib or hamper with a baby in it can be kept at an even temperature, varying only about one degree from the standard decided upon, the air being slightly moistened, and a glass cover permitting all the personal watchfulness that may be desired.
The device is shown in the accompanying engraving, the case being of wood, divided horizontally into upper and lower compartments, A and B, by a shallow inclosed tank of water, C. Albove the water tank, and supported on slips of wood, D D, is a cradle for the reception of the infant, which lies under a glass window, E, hinged at the back, and connected with a lever plate, $F$, the latter also connecting with a thermometer and an alarm hell. Through the hole, M, at the bottom fresh air is regularly admitted, passing through a cap, P , and two layers of coarse canvas, N , the latter dipping into a metal water tray, O, to keep the canvas through which the air passes always moist. To the right is a gas flame, the heat from which passes through a flue, R R, shaped like the letter $U$, so as to twice traverse the length of the water tank, to heat the water. For the regulation of the temperature a metallic capsule, S , containing a liquid which boils at $90^{\circ}$, is fixed near the head of the cradle, and connected with a light lever V pivoted to the lever plate, F. From the free end of this lever hangs lever plate, F. From dite free end of this laterer hangs plied by the gas flame or lamp. If a higher or lower temperature be desired, the device can easily be adjusted therefor. This apparatus differs from the French device for a similar purpose, which was fully described in Scientific American Supplement, No. 434 , in that the regulation of the temperature bere is entirely autumatic. The use of this "thermostatic nurse and the so-called French "haby incubator " of Dr. Tarnier his been highly recommended by hospital managers, as conducing largely to the saving of life among infants that must be raised in public institutions. Perfect ventilation and even temperature are especially important for infants of low vitality, and by means of such apparatus it is said that in 145 cases at a Paris hospital, where the infants weighed at their birth only about four pounds, the average mortality was reduced from 66 to 38 per cent.

## POST MORTEM ATTITUDES

Dr. Brown-Sequard has recently published an interesting paper* upon the post mortem preservation of the attitude that the subject presented at the very mument.life ceased. In giving these facts the principal object of the author was to seek the cause of the phenomenon; but he arrived at the conclusion that a solution of the question cannot be reached | to |
| :--- | :--- |
| dead | in the present state of science.

If this delicate problem embarrasses the learned phy siologist, I certaiuly have not the pretension to offer in this place a satisfactory solu tion. My only object is to point out a few facts of special nature that Dr. Brown Sequard did not allude to As these are capable of throw ing light upon certain point of the question, and of thu helping its solution, I have thought it worth while to make them known.
In order that this pheno metson of the preservation of the last attitude may manifest itself, a few peculia conditions are necessary, the principal of which appears to be a violent, instintaneous, or quick death. But sucha con dition very often occurs with out a preservation of the at titude being observed; and on another hand, cases are likewise cited where death seems not to have been in stantaieous, nor even very quick (relatively at least), such as the case of a wound in the thigh. There has also been invoked, as an active cause, the moral influence exerted upon the sulject in cases where deaih was not instantaneous, or at least in those in which the subject has had a knowledge or quick perception of the danger that menaced him. Without any explanation of the immediate causethe starting point of this instantaneous action of the nervous s. stem-the thing itself has been designated as sideration. Now. in pointing out the causes of death that have given rise to a preservation of the attitude, Dr. Brown-Sequard has omitted to mention the cases in which this expression of sideration can be applied in all is fullness, properly and not tions. dead.
figuratively, and that is in those cases in which death has been caused by lightning.
Such cases are quite numerous, and some details have been ascertained that may throw a light upon the question. shall, in the first place, cite the most remarkable observa-

1. One of the oldest facts is related by J. B. Cardan, who published a work upon lightning at Lyons, in 1633 Eight farm hands had taken refuge under an oak, in order to protect themselves from a storm, and to cat their lunch. A peal of thunder was heard, and the eight persons, struck dead by lightning, remained in the position that they were occupying. One of them was bolding a glass, and another was putting some bread into his mouth, without any modification of the facial expression having occurred. 2. The preceding fact left some doubts, aud there has


## THE THERMOSTATIC NURSE

been a disposition to believe it an exaggeration, but another and identical one was afterward reported hy a Protestaut pastor, Butler, who was a witness of it. On the 27 th of July, 1691, at Everdon, ten harvestmen took refuge under a hedge upon the approach of a storm. Suon afterward a thunderbolt fell and killed four of them, who remained inmovable, and as if petrified, in the very attitude that they had at the time. One was holding between his fingers the pinch of snuff that he was about taking. Another was bolding on his knees a dead dog which he was caressing with one hand and offering a piece of bread to with the other. A third was sitting with his eyes wide open and his head turned in the direction of the storm.
3. Abbe Richard relates that the proctor of the Seminary of Troyes was returning upon horseback, when he was struck by lightning. A brother, who was following him, not having perceived it, thought he was asleep because he saw him ottering. Upon trying to awaken him he was found to be


## death by lightning

4. Another and analngous case is likewise related in the unereal annals of lightning. A priest was struck while upon horseback, without the animal being injured. The later continued his accustomed route, and reached home with the dead horseman, who sill preserved his attitude. The distance thus traversed was about two leagues.
5. On the 9th of May, 1781, at about three o'clock, the lightning struck the don of the chapel of the Commandery of St. John, near which a woman and three children had taken refuge. The woman, who was seated in front, was suffocated without changing attitude, as was also one of the children.
6. On the 14th of August, 1793, a man, surprised by a
storm in the environs of Dover, took refuge with four horses in a thicket. A thunderbolt having fallen, the four horses and the man were killed, with the peculiarity that the later remained seated.
7. On Sunday, July 11, 1819, the church of Chateauneuf (Lower Alps) was struck by lightning during divine service. A large number of persons was struck ( 82 wounded and 9 killed). The peculiarity to be pointed out is that all the dogs that were in the church were found dead in the attitudes that they previously had.
8. At Vic-sur-Aisne in 1838, three soldiers, in the midst of a violent storm, took shelter under a linden, when, by the same stroke of lightning, all were instantaneously killed. Moreover, all three remained standing in their original posiion, just as if the electric fluid had not touched them. Their clothing was intact. After the storm, some passersby who saw them, having spoken to them without getting any answer, approached and touched them, when they all fell into a heap of ashes.
9. In the month of July, 1845, four inhabitants of Heilz-le-Maurupt, near Vitry-le-Francois, took refuge, three of them under a poplar and one of them under a willow. Soon afterward, the one who was under the willow, and leaning against it , was struck by lightning. $\dot{A}$ bright flame was issuing from bis cluthing, but he did not appear to see it. "You are burning! Don't you see that you are burning?" cried his companions (see engraving): Upon running to him they found he was a corpse.
10. An animal forms the subject of this observation, which was made after a winter storm, in January, near Clermont. A goat was struck by lightuing and immediately killed. It was found standing upon its hind legs still holding a green branch in its mouth.
11. A young woman, the wife of a miner of Ricamarie, had gone to visit her family at Saint Romainles Atheux, taking with her her four monthes old child. It was on July 16, 1866, and she was alone in the house during a storm. When her parents returned from the field a sad spectacle awaited them, for the young woman had been killed by lightning. She was found on her knees in a corner of the room, with her face concealed in her hands. She bore no trace of a wound The chid which was lying on the bed in the room, had been but slightly touched by the electric fluid.
12. I have related the preceding observations in chronological order, but I terminate with one, nevertheless, that should have come first. It is narrated by Quintus Curtius (lib. viii., cap. iv.). Alexander the Great was traversing Asia and spreading ruin on his way. When he reached the region now called Bokhara, his army was assailed by a frightful cyclone. This terrible tempest carried off nearly a thousand men-soldiers, sutlers, or valets. It is stid that some of these were found leaning against the trunks of trees, and seeming to he still alive and talking with each other, in the same situation in which death had overtaken them.
The observations which precede seem to us tofurnish some useful. information in regard to some points of the question. Thus a perception of danger is not necessary to explain the influence exerted upon the subject. The case of the soldier observed at Beaumont, near Sedan, seems to be demonstrative. He was not conscious of danger, by $r_{\text {eason of the quick and un- }}$ foreseen action of tise bullet. This cause most certainly cannot be invoked in case of death through lightuing. It is perfectly demonstrated by numerous observations that the subjects thus struck have not and cannot have any apprehension of their imminent danger. The person who is struck by lightning not only does not hearthe noise of the thunder, the propagation of which is relatively slow, but he has not even any perception, any warning, of the flash, whose rapidity is proverbial. Death is instantaneous, and the subject bas not experienced the moral influence that results from a perception of danger. We have particularly related the cases that comprise animals (obs. 7 and 10). These could not have had any such apprehension. It is remarkable to see that all the dogs were struck, and that all preserved their attitude in the occurrence at Chateauneuf, while the number of human victims was proportionally much less. None of these latter, moreover, preserved the attitude that he had at the moment of death. In obs. 6 a man preserves his position and remains seated near four dead horses that did not maintain their attitude. In obs. 1 we see that all the individuals exposed to the action were killed, and all (to the number of eight) preserved their attitude. In the second case four out of ten were struck, and the six others do not appear to have been influenced by
the electric fluid. In short, all those that were struck dead preserved the last. attitude of life.
Cases of lightning stroke are unfortunately quite numerous, but the number of those in which a preservation of the attitude has been observed is relatively limited. Although there are no comparative tigures upon which an exact proportion can be established with certainty, it nevertheless appears that they are more frequent after lightning stroke than after other modes of sudden death.
Let us further remark that in cases of death by lightning, with a preservation of the attitude, it has been found that no external lesion exists (obs. 11) upon the body of the victim, and no autopsy bas shown what point was thus influenced without any apparent contact. Perbaps no peculiar alteration could have been found in the essential organs of life; and it is especially in such cases that we may employ the expression sideration in all its acceptations.

The peculiar circumstances that accompany death by lightning may acquire (as they have done) a certain importance from a medico-legal point of view. But I have not to concern myself with that here, my only object having been to point out a few interesting facts, whence we may draw some useful data for the study and solution of this question of post mortem preservation of the last attitude of life. Dr. J. Rouyer, in La Nature.

## Manufacture of Soda.

The Leblanc process of manufacturing soda is carried on at the works of the Newcastle Chemical Company, which have been in operation 50 years, and are so extensive as to cover more than 60 acres of ground. Some idea of the magnitude of the operations of this company is conveyed by the fact that they manufacture upward of 60,000 tons of products per annum, comprising suda ash, soda crystals, refined soda, and bleaching powder. A large number of auxiliary processes are included, such as repairing shops, fire brick works, gas works, and a very extensive cooperage, capable of turning out 1,000 casks per day. Several of Wilson's gas producers have been erected at these works, and yield satisfactory results. The following is an outline of the processes carried on: Sulphuric acid is produced from pyrites smalls (which contain about 50 per cent of sulphur) in the usual lead chambers. The sulphuric acid is used for decomposing common salt; thus producing hydrochloric acid and sulphate of soda. The latter is mixed with a proportion of limestone and small coal, and fluxed into a uniform mass in large revolving cylinders; thus producing "black ash." The liquor obtained by lixiviation of this black ash with water is a solution of carbonate of soda, which is obtained in the dry form by evaporation. This is further refined by resolution, and allowing all soluble impurities to settle out; and the refined liquor when evapo rated yjelds ordinary washing soda. The hydrochloric acid is collected by passing the gas into towers supplied with water, similar to gas works scrubhers, and packed with brickbats. It is used for the manufacture of chloride of lime (bleaching powder).

CHEMICAL OBSTRUCTIONS IN IRON WATER PIPES.
We take the following illustration and notes from a pape read hy Col. Win. Ludlow before the Engineers' Club of Philadelphia. The illustration is of a specimen of water pipe which had been taken up for the improvement of the water supply to certain dwellings in Philadelphia. It is of two inch pipe, about twelve inches long, and had beco it the ground twelve to fourteen years, connecting the main in the street with the house fixtures. Upon testing the water pressures with a gauge, it was found that the bydran in front of the house had a pressure of seventeen pounds, which was reduced in the kitchen of the house to seven pounds, the difference clearly indicating an obstruction in the service pipe. The pipe having been taken up, a piece was sawed longitudinally, when the interior was found to be nearly filled with a deposit composed of the sesquioxide of iron and sedimentary mat ters, the tortuous cbannel through the pipe being constricted at several points to about three-eighths of an inch. Another piece of obstructed pipe, originally three incles, which had been in the ground over thirty years, bad become almost entirely closed from the same canse.

Discoveries of this kind are constantly being made, and pipe that has been in the ground over ten or twelve years cannot be depended upon to convey its full volume Two methods of obviating this difficulty other than galvanizing, which was not considered advisa ble for a supply of water for drinkiug purposes, were known. The one in use by the department (Pbiladelphia) for its large mains, namely, coating the pipe when newly made with a coal tar pitch prepared and supplied in ac cordance with certain specifications, apparently protected the pipe for a period of from twenty-five to thirty years. This, however, would be less advantageous in the case of small service pipes, for the reason that it decreased in a considerable proportion the available diameter. The other method was a process known as the 'Bower Barff,' which consisted in coating the pipe with a film of magnetic oxide produced by subjecting the iron to the action of superheated steam or air under certain conditions. This pro cess promised good results,"


CHEMICAL OBSTRUCTIONS IN IRON WATER PIPES.
so the ruling of the Patent Office has been tending somewhat of late, as it appears to us, to establish a policy of exclusion based on the merely chimerical hypotheses suggested above We do not say tbat there never has arisen, or never wil arise, an instance where an invention is so merely seeming and not substantial as to lack the real merit of an advance or that sometimes a so-called invention may not be simply the result of a workman's skill. We grant that very un frequently such an instance may arise, possibly once wher the assertion of the one or the other change is made a hun dred times.
But we do allege that the law supposes, takes it for granted, admits, assumes, that an improvement is an advance, nd so says it shall be patented. Who so good a judge of bas given her.
the man who at the work bench, in the factory, on the farm or in some other hard, prosaic, and rough school, having solved the problem and made the improvement, pays the costs aud charges of obtaining the patent, and is willing to bear all the risk of makiug anything out of the patent? The mere possession of his letters patent confers no power on the patentee to work havoc on an innocent public. The courts are open to all to show that the improvement is no good, and equally open to the patentee to prove his case. No small boon this last.

At the recent Ciacinnati Convention one of the inventors in attendance told us a tale which disproves scores of the fine spun decisions of the Patent Office on the grounds named above. This party a few years ago was as poor as poverty had a large family, was blind in one eye, had no friends to help him, and was about to call his game of life a dead loss to all interested. One day, while fixing up, as best be could, the miserable apology for a rail fence that inclosed the few thin and worn mortgaged acres about his home, he hit on a plan of saving one rail in each panel. It was a revelation to bim, so he jobbed out around the country, mending his neighbors' fences on this saving plan. After a while and by exertions, the narrative of which would moisten any hearer's eye, he scraped enough money together to enable him to apply for a patent. As a matter of course, in those days his case was rejected over and over by the examiner Finally he appealed, and by good luck got the ghost of a claim. In a few months, by sales of patent rights, he had paid the large costs and interests on the money borrowed to get the patent, and cleared some three thousand dollars besides. This patent was simply a starter, for he invented many improvements in fencing, farm gates, etc., till now he has more than a dozen patents. He is said to be worth upward of $\$ 30,000$ to-day, and to be held in great esteem by his neighbors as a driving, steady, honest business man We do not intend to convey the impression that every so called small invention can be made a like bonanza. We do insist that under the law every improvement is patentable, and no man or men in the Patent Office have the right to say how much this improvement shall be before the paten can be granted.

Progress of the Russian Petroleum Industry.
It is claimed by an English writer that although the pho tometer indicates that the ordinary American oil is capable of yielding in the best lamp a greater amount of light, irrespec tive of the quantity of oil burned (especially when the lamp bas been recently filled and trimmed) than the Russian oi affords in the same lamp, yet the latter gives what the con sumer would call a good light, not only at first, but after several hours' burning, and actually furnishes more light per gallon of oil burned than is afforded in the combustion, uuder similar circumstances, of three out of five samples of ordinary American oil examined, and but little less light is yielded by an equal quantity of the American water-white oil tested.
The experiments made at the instance of the German Gov ernment have proved a like result, and European testimony is very clear on the question of quality. The crude naphth does not give so large a quantity of burning oil as the American naphtha-only 25 to 30 per cent-but the low cost of the crude naphtha is so trifling, and the value of the 70 per cent of residue for the manufacture of other oils is so great, that the compensation is quite sufficient for the lesser quality of the compe
kerosene.

The conclusions arrived at are easily summed up thus Russian kerosene (petroleum hurning oil) will, withou doubt, before long drive out the Anierican oil from all parts of Eastern Germany-it has already done so from the town near the Russian frontier. Gradually the same result wil arrive throughout Austria and all the coun tries bordering on the Danube. Later, but also surely, American oil will be driven from central Germany, and from the countries nea the Mediterranean Sea, while the lubricating oils and other products bave already taken firm stand in all the capitals of EuropeLondon included. One of the men who bas done much to introduce naphtha products into Europe, M. Ragosine, is even sanguine enough to declare that he will sell machinery oils of Russian manufacture in America, and many of our burning oil makers are looking to London and Bremen as the future markets for large quantities of their products. They will not be contented with supplying Turkey, the East, China, Japan, etc., but want th larger and nearer markets of Europe. They couple with this the use of masouta, or liquid fuel, as something which will give Russia a large export trade and enrich the country by thus disposing of the large supplies nature

## Permeability of Silver for Oxygen Gas.

by l. troost.
The author proves that pure oxygen and the oxygen of atmospheric air are capable of passing through the sides of a heated tube of silver, while a mere trace of nitogen pene trated the metal. Carbonic monoxide and dinoxide also permeate silver, though more slowly than does oxygen. The author suggests that pure oxygen may be obtained from the air on this principle. The temperature of the metal must not exceed $800^{\circ}$.

## ENGINEERING INVENTIONS.

A fascine for the protection of harbors has been patented by Mr. Jacob Elmer, of Bilozi, Miss. I consists of a tubular body made of saplings bound to
gether and filled with stones, the diameter of the fas cine to be from one to three feet, and its length from ten to forty feet, for the protection of
A spark arrester has been patented by Mr. James N. Weaver, of Sayre, Pa. This invention covers improvements on a former patent issued to the same inventor, and includes certain means whereby cinders
or dirt are prevented from being drawn into the valves or cylinders, an even dranght on the fire is secured, and an increased length of smoke stack within a give space is obtained, with other novel features.
A car coupling bas been patented by Mr. Patrick Ryan, of Guelph, Ontario, Canada. The drawhead has a pivoted coupling hook, with a transvers
bar under connected with a bar having the outer end pivored to the car, and the inner end pivoted to th transverse bar, the inner end of the pivoted bar being lransverse bar, the inner end of the pivoted bar being
connected with a spring for pulling or pressing it upward, and pressing the coupling hook up into the draw head.
A steam boiler has been patented by Mr. William F. Hatcher, of Chariton, Iowa. This invention relates to improvements in boilers designed to hea houses, the boiler being cylindrical, with an inner conto the shern exhet and extending across the shell its upper end, thus forming a continuous cylindirical waterspace closed at the bottom and opening atits upper end into the steam and water space, and keepiug up a constant water circulation.

## MECHANICAL INVENTIONS.

A bench book has been patented by Mr. James McVane, of Boston, Mass. It is constructed with two bolts held to slide vertically on a plate, the
bolts having their lower ends pivoted to the ends of a bolts having their lower ends pivoted to the ends of
lever pivoted on the plate, whereby one bolt will be lever pivoted on the plater is lowered; the bolts can be
raised whon the other for holding planks on the bench flat or edgewise.

## AGRICULTURAL INVENTIONS.

A grain sower has been patented by Mr.John B. Wright, of Ridge's Creek, N. C. This inventio covers a combination of harrow with pivoted beam, supplemental beam pivoted thereto, and carrying the driving wheel, lifting handle, catch and cord, semi-
circular hopper, with other novel features of construc circular hopper, with other novel features of construc
tion.

A plow cleaner for sulky cultivators has been patented by Mr. Charles $\in$. Ridey, of Mapleton,
Iowa. A scraper is connected wilh the plow beam, the arched axle, and the coupling sleeve of the cultivato by bars so arranged that the partial revolution of the
slecve will move the scraper downward and the plow beam and plow plate upward, with other novel features.
A combined cotton cultivator and chopper has been patented by Mr. James W. Roberts, of Moody,
Mo. A frame is mounted on wheels, with au axle, and carrying standards and beams convected with the frame by hooks and staples, and by levers for scraping and struction, to facilitate the cultivation of cotton, an promote convenience in controlling the machine
A novel quilting machine has recently been patented by Mr. Evans Wood, of Lyons Station,
Texas. Combined with a needle frame adapted to carry a series of needles are a feed plate, eccentric shaft rock shaft, and various special features of construction it being designed to operate the machine at the rear
of a cotton condenser of a cotton gin, so that the thick bat of cotton as it issues from the condenser may be fed between the upper and lower webs of cloth use fed between the upper
for making the quilt.

## MISCELLANEOUS INVENTIONS.

Improved neck wear is the subject of a patent issued to Mr. Howard Selvage, of Brooklyn, N. Y
The invention consists of a neck wear shield with a diagonal or oblique edge, a pin projecting from the edge adapted to hold the free end of the neck band A moistening case for cigars has been pa tented by Mr. Charles N. Swift, of New York city. The invention covers a tobacco case, with a removable per-
forated bottom, and a removable moistening tray, sliding beneath said bottom, so the cigars can be kept moist by the moisture in the tray.
A grain cutting machine has been patented by Mr. John B. Frost, of Cuyahoga Falls, O. Comapertures tbrough the rim, is a reversely revolving cutter drum, with cutters and gauges, and $\mathbf{v}$
features of construction and arrangement.
eatures of construction and arrangement.
An earth scraper has been patented by Mr. David Harper, of Jonesborough, Ark. The scrape bowl has a point at one side of its forward end, and
the forward edge of its bottom slanting rearward from this point to the opposite side of the scraper bowl, the lower side corners of the scraper being grooved.
A pillow sham holder has been patented by Mr. Jonathan A. Pierce, of Austin, Minn. This invention provides a simple and inexpensive device for velion provow shams in place over the pillows of a bed,
holding pillo
and for holding the shams in raised position while the and for holding the shams in raised position whil
bed is in use, or when being made up for the day. A cuff retainer has been patented by Agne L. Franklin, of Frankfort, Ky. This invention con sists of a pointed slud attached to the sleeve button, which the cuff is worn, the object being to provide a place upon the wrist.
A middlings purifier has been patented by Mr. David L. Ellis, of Brookville, Pa. This invention
consists in certain novel features of construction in the grading reel, in the screens, in the arrangement apacity on little floor space, and save grading ma hines, spouting, and other now needed appurtenance An automatic register for grain, feed, and oiher substances has been patented by Mr. John
Wherry, Jr., of of Putnam, Ill. This invention is to Wherry, Jr., of of Putnam, Ill. This invention is to
improve registers formerly patented by the same in improve registers formerly patented by the same in
ventor, and by novel features of construction render the meter less liable to become choked o
A shaft buckle for harness bas A by Mres harness bas been patent device for single harness contrived to be hitched in he trace and buckled around the shafts in a manner t provide simpler and more substantial means for connecting the shafts, traces, back strap, and
than is afforded by other means now in use.
An adjustable desk and seat has been pa ented by Mr. Herman W. Groebl, of Vincennes, Ind. This invention covers peculiarities of construc tipn whereby school seats and desks, office desks, etc.
can be adjusted higher or lower, as desired, and lock ed in position, the seat being adjusted independently of the desk, and the desk independently of the seat. A stop watch has been patented by Mr s.rs in C. Scott, of Brooklyn, N. Y. The invention on of the arm of the lever for operating the chronograph mechanism of a watch movement, the arbor to receiv
the square winding ar'bor of the watch, the shoulder the square winding arbor of the watch, the sho
which winding arbor operates the said lever. A hand power lifting and force pump ba een patented by Mr. Olof Patterson, of New Boston Ill. This invention covers a novel construction t
facilitate the raising of water from any depth, with facinitate the raising of power, and to reduce the wear on the working parts and the amount of atte
A saddle for horse collars has been patented by Mr. Christopher G. Calo, of Newark, N. J
The invention consists in a saddle constructed to fil pon the top of a horse collar, with side loops to re eive thill or tug straps, so the thills or tugs can be upported from the collar, and with other novel fea cures to simplify the
A garbage separator bas been patented by Mr. George T. Waldeck, of New York city. The inven whter tank with a chute, and drums journaled in the tank, an elevator belt, and operating devices, constiuting an apparatus for separating ashes, cinders, and ther powdered refuse from bones, rags, and coars
An ear guard has been patented by Mr. William T. King, of Grand Rapids, Wis. The inven
tion covers a combination of plug to fit into the ear, tion covers a combination of plug to fit into the ear,
pad to rest on the face, braces, and a spring hook, protect the ear from being injured ly loud and sudden sounds, such as the firing of artillery and the noise of mills, as well as to protect the ear from wind or cold A car beater has been patented by Mr . Richard H. Brown, of Omaha, Neb. In combinatio with a stove extending above and below the car floor,
there is a tank below the floor and a coil within the ove connected with the tank, with other arrange ments for making a low pressure steam heater, de
signed to provemore efficient and safer than heater now in use.
A carpet stretcher bas been patented by Mr. William Hill, Jr., of Limestone, N. Y. The stretcher has a toothed head pivoted to a lever, in com
bination with a pivoted bar, having a pivoted dog, and other novel features, so the operator may fasten the
strelcher with the carpet held in position and tack trelcher with the carpet held in position and tack down the carpe
A carpet stretcher has been patented by Mr. Charles A. Cooper, of Chicago, III. The invention
consists in a metal plate or drag with teeth at one end consists in a metal plate or drag with teeth at one end,
the other eud being connected by a loop with a slotted lever, a curved projecting from the plate on the oppothe under side, and therefore cannot injure the face of the carpet.
A process of moulding plastic substance has been patented by Mr. Chester A. Weller, of New
York city. This invention provides a specially conrived press for moulding clay, artificial stone, etc. aving a cylinder with an opening in its bottom, ing platform under the cylinder, a mould plate hinged oo the platform, with other novel features.
A sleigh knee has been patented by Mr. with a sleigh knee or leg are hook rods held in groove in the side of the leg end, passed through the cross piece and having nuts screwed on the upper ends; rod projecting upward from the runner pass through lon nd through the cross piece. An earth scraper bas
William H. G Goode of Siden patented by $\mathrm{Mr}^{2}$ William H. C. Goode, of Sidney, $\mathbf{O}$. By this inven-
tion about one-half the material of the ordinary back plate is saved by curving up the rear end of the bottom long the curved rear edges of the sides, and the back is thus made curved from bottom to top without the necessity of forming the sides in separate pieces from the bottom.
A combined rule and square has been paNited by Mr. George D. Umland, of Osceola Mills, ins. The invention consists in attaching to or formblock, which, when the outer section is folded inward, laps over the knuckle joint at the middle of the rule, and forms a stop, against which the other section of the abuts when it is exactly at right angles.
A transmitter for telephone time systems as been patented by Mr. Charles W. Ruehle, of Detroit,
Iich. The invention consists in combining with a
clock movement a circuit controlling apparatus to send electric signals at one second intervals, an intermitting stopping and starting mechanism for determining time of sending signals and limiting their duration.
A side spring carriage has been patented by Mr. Antipas P. Marshall, of Lancaster, N. H. By th invention the springs have their ends estended the springe, and the links are of correspondingly in creased width, with sbackles to conform, thereby giv ing bearings of increased width, to prevent side sprin carriages from swaying or swinging sidewise
A device for casting printers' leads has Y. The invention covers a simple hand apparatus, in which two frames are hinged together, with plates on their inner faces, one of which is adjustable, to make
leads of different sizes requifed, whereby printers may onveniently use old leads or type meta
A lifting jack has been pate
Mring jack bas been patented by Mr ohn W. Clarke, of Hallowell, Me. With an adjustarating the lifting block, and straps or cords in adjustable connection with the lever and Hock, making a double adjustment, giving great lifting power with lit-
te weight, and the construction admitting of the jack ine weight, and the construction admitting of the jack being $u$
wheel.

A sun dial bas been patented by Mr. Hugh Christian, of Chagrin palls, o. Wis inventio combines two half ring dials with longitudinal lines
and transverse sligiuly curved lines. with two balls, and transverse sligilly curved lines, with two balls, for adjusting them for different latitudes, one scale and one dial being for each half of the year, and the dial being calculated to give the time by five-minute marks.
A permutation padlock has been patented by Messrs. Cbarles E. and Albert G. Smith, of Wash-
ington, Ga. By this invention the sliding bolt is prongton, Ga. By this invention the sliding bolt is pro vided with a thumb piece projecting through the case for operating it, there are oppositely revolvable disks
with recesses in their adjacent peripheral edges, so when recesses in their adjacent peripheral edges, bolt, the bolt may be thrown or retracted, with other novel features.
A lifting jack has been patented by Mr. Gardner Hunitting, Jr., of East Hampden, Me. An axle and levers, the lower ends of counecting bars bein pivoted to the latter, the bars having their upper ends pivoted on the axle support, so the support will be raised and locked in place by swinging the lever down
against the standard, thus making a simple, light, and gainst the standard, thus making a simple, lig
strong jack, without screws, catches, or springs,

## 

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ighest average percentage from full to half Gate of any wheel. Every pizce tested and tathos gull to halanted. Send fore
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the whole range of engineering, mechanics, and physiAddress Munn \& Co . Puoblishers, New Yor Machinery for Light Manufacturing, on hand and
built to order. $\mathbb{l}$. E. Garvin \& Co., 139 Center st., N. Y Curtis Pressure Regulator and Steam Trap. See p. 78 Munson's Improved Portable Mills, Utica, N. Y Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 77. C. B. Rogers \& Co.. Norwich, Conn., W'eod Working Drop Forgings. Billings \& spencer Co., Hartford, Con Mineral Lands Prospected, Artesian Wells Bored, by
Pa. Diamond Drill Co Box 423 . Pottsville. Pa see p. 93 We are sole manufacturers of the Fibrous Asbesto emovable Pipe and Boiler Coverings. We make pu 19 East 8th Street, New York.
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catalogue to Rowley \& Hermance, Williamsport, Pa. The Porter-Allen High Speed Steam Engine. South
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give date of paper and pacles give dqte of paper and page or number of question,
Inquiries not answered in reasonable time should
be repeated; correspondent will bear mind
some answers require not a little research, and, some answers require not a litile research, and,
though we endeavor to reply to tall, eiller by lettei
or mail. each must take his turn.

 such service without remuneration.
Scientific Alnerican supplents referred
to may be had at the office. Price 10 cents each. to may be had at the oftice. Price 10 cents each.
Minerals sent for examination should be distinctly
marked or labeled.
(1) G. W. C. asks how to make a copying pad for copying letters.
purpose is the following:

(2) D. W.-The use of diluted salt water is egarded as a most excellent tonic for the eyes; as to
whether its use will permit the laying aside of glasse is a consideration which depends upon so many cir cumstances that we cannot answer it. Certainly, how-
ever, it can be said that, if the glasses are worn for weak yes, quite likely they may be given u
(3) E. A. K. asks if there is any kind of sheet iron or steel which will stand the heat of molten (4) F. Q. asks the temperature of an egg to hatch. A. The temperature in incubators is steadily It
K.To soften paint brushes that have become hard, soak them twenty-four hours in repeating the process till clean; or wash them in ho soda and water and soft soap.
(6) P. O. D. asks if there is an instrumen or liquid that, by placing on the ground, will indicate any mineral. A. There is no satisfactory method njetermining mineral deposits except by having od amination by $\varepsilon n$ expert mining engineer. The com pass will indicate the presence of irou, but unless use
anderindianl would be unsatisfactory
(7) M. E. E. writes I am anxious to learn how to preserve natural flowers. Could you give me Che process in this way? A. Dip the flowers in meltee
paraftine, wihdrawing them quickly. The liquid should be only just hot enough to maintain its fluidity and the flowers should be dipped one at a time, held by the stalks and moved about for an instant to ge rid of the bubbles. Fresh cut flowers, free
(8) J. T. V. asks: What is Crême d'Argent Please give formula. Would its application to stamp plication of quickeilver, and prevent the rising of the xide of copper through the quicksilver d'Argent is silver cyanide. Its application is to pro duce a eilver coating in Hamerton's positive process,
of engraving or etching. We think it would be too expensive for your purpose
(9) J. P. W. asks in what book he can get暲 phates and other commercial fertilizers. A. This in-
formation can readily be obtained from any text-book on analytical chemistry, such as Fresenius' Hand-Book of Quantitative Analysis or Cairns' Manual of Quan tative Analysis.
(10) B. B. S. writes: Will you please le e now if there issome cheaper copying process tha he electric pen that will do good work? I wish some
hing for examination papers in school, so I cail ake impressions from same. A. Use the hektograph described in our SuPPLement, No. 443.
(11) C. N. L. asks if there is any sulphur us odor at or near the locality where lighning strikes . There is an odor of ozone. There might ae au containing sulphur.
(12) J. B. asks if paper pulp can be run ntomoulds, and if it can be hardened, and to what extent, if so.. A. It can be pressed into moulds, and if
mixed with size will become hard when dry. Clay is mixed with size will become hard when dry. Clay
(13) J. W.-We think the process you re fer to is not nickel plating, but tinning. The knives ing fluid, then dipped in a bath of melted tin. The tin covered with wax or tallow to prevent oxidation We know of no practicable process of nickel plating without a battery
(14) W. L.-London cement, for mending broken glassware, china, ivory, etc... is prepared by time allowing the water to evaporate, and taking th aste thus left and thoroughly incorporating it with ry quicklime. It will mend glass, wood, china, etc very effectually.
(15) T. L. G. says: I have heard stated that four persons could lift a heavy man from the floo without the least effort, by taking together a long, deep breath and puting their forefngers ander the one to
be lifted at the same time. If true, how can it be explained? A. If each of the four persons is able to lif one-foutti or the weight with his foreinger, there it ntire weight. There 18 nothing mysterious about it
(16) C. C.-Coning the wheels is intended prevent most or all of the sliding of wheels on ave each other, there will be no slip.
(17) W. J. L. asks: What is a non-con ductor to magnetism? I have tried a number of metals, at atract brass, but it will attract through it, An insulator of magnetism has long been sought ever found.
(18) E. M.-Siemens said that electrical enineering is simply an adjunct of mechanical or civil engineering. As a profession, apart from these, it
would hardly be desirable. You can take a course a one or the other of our technical schools, or you can
gain the practual part by engaging yourself in some gain the practical part by engag
(19) I. W. R.-Probably the readiest way mix lampblack with very thin shellac varneh and apply with a small eponge on a stick. Use a liberal quantity of lampblack and very little shellac. Try
your varnish on a piece of metal before applying it to your tube.
(20) W. M. C. asks: Will a ship sink to the bottom of the sea, the depth being 5 miles, and the
reason? A. If it would sink at all, it would go to the bottom. The reason is that water is practically incom pressible, and a given bulk of water at the bottom of the ocean weighs scarcely more than the same bulk a
the surfuce: and any body having greater weight than the surface: and any body having greater weight tha bottom of the ocean as at the top.
(21) T. D. M.-We think your method of destroying weeds, ele., , means of a heated rolle vould be impracticable, as earth is a very poor con
ducior of heat, and you would require not only a very ot roller but a very slow movement.
(22) W. R. C.-We caunot suggest a re medy for your diffculty without knowing more about teed fine wire on your heons? used ne wire on your hobins? Are your pole esten-
sions very near the diaphragms? Is your fence wire erfect throushout, or is there a break or a bad join
(23) R. J. O'R. asks the present condition of the Hudson River Tunnel. A. On the New York
side one tannel has been built about 200 feet, through the oulkhead of the pier. On the New Jersey side one tuanel has been built 1,600 feet and another 600 aving been stopped for about a year from want o unds.
(24) J. D. G. asks a simple rule to de ermine the amount of condensation per squarefoot arface on steam pipes of different thickness and tem-
erature. A. We do not know of any simple rule sucd s asked for, but the followng is the resulr of experi nent. Steam pipes used for heating a room and main condense $0 \cdot 357$ pound $60^{\circ}$, with good circulation, w face, each hour; a coil under similar conditions will ondense $\mathbf{0} 29$ pound of steam.
(25) P. W. W. asks: Would not a lathe nack und the side rest is made to travel by means of oolly have a racck and prinion without backlash, and
easily reversible. The method is not impracticable, easily reversit
(26) W. R. P. writes: Will you please give me the best formula for making ink for copping pad A. sy the following: Dissolve one part methylvile add, when cool, two parts of glycerine.
(27) J. W. writes: I wish to learn how to he roe bluing used by washwomen and sold by all
the Diseolve indigo sulphate in water, and filter. 2 Dissolve ood cot on bue such as aniline blue 6 B in cold wate
Dissolve Prussian ilue with one-eiphth part of oxali aid in water. 4 Dissolve Tiemann's soluble blue in cent of oxalic acid.
(28) J. J. McV. asks:What are considered to e the best materials and proportion or ingredients, firon, railway and highway? A. There is nothin hat st mids wear and weaher so well as red oxide on and boiled linseed oil. This may be tempere with chrome yellow, white lead, and lampblack fo shades. On the great East River Bridge white lead is sed. The elevated ranways in New York are painte is not desirable to have the paint dry quickly, a little aw linseed oil mixed with the boiled ma
(29) J. H. asks how to make a cheap steam wistle, one that is loud, but not shrill. I intend to se a globe valve, if possible, so 1 w wil start to whistle
radually and die out gradually. A. A tinsmith could make you a steam whistle upon the same plan as a ordinary mouth whiscle or an organ pipe, only on arge scale. We do not think that you can make on
(30) J. M. F. asks the latest receipt for the manuacture of carbon paper for use on the typ rite. A. We know or so more saisfactory metho than that of rubbing the surface of thin post or tissue
paper with black lead and a little oil, and carfefuly removing theexcess of coloring substance by rubbing with a clean rag.
(31) F. C. C. asks: In regard to the powe of a small boat engine and boiler of the following di
mensions: Boiler 11 nnches diameter, 24 inches high xteen 1 inch flues, fire bor 10 inche diomer, nches high, engine cylinder 2x4 inches, 3 inch stroke 00 or 50 pounds steam, half an inch feed. A. Your
boiler, with good strong draught, would give you from 174 to 1/2/ hore power. The engine can furnish no (32) B. E. G.-The vessel from which the ir is exhausted is ligher in consideration of the air stracted, therefore it will float easier than one contining ar. The floating of a vacuum inclosed by
metalic case depends entirely upon the weight of the ivelope
(33) T. E. G. asks what he should use to aint a boiler with. Something that will not burn off "smoke pipe paint;" the coal tar varnish can be ab tained from gas worlis.
(34) W. S.-The reversal of the valves anket the cylinders act as pamps driven by the moefore the pistons and driving it back into the steam

(35) S. P. B. says: I use a two flued boile 4 feet long, and use coal for fuel. I thought of making an experiment with coal oil to increase the heat in the
aues by combustion of coal oil in atoms. I wonld con uct the coal oil to the flues through a quarter or hal inch pipe. Would there be any danger in exposing th pipe, say a quarter or nalf an inch diameter, to a re
heat? A. Not if of wrought iron. But a better was would be to send the oil into the furnace on a " spray by a jet of steam, an operation similar to that of an in -
(36) C. L. B. says: I am a machiuist; have
 engineer. I am studying the indicator, and have learned to work up a card to a certain extent. but can-
not understand the true curve, or theoretical curve, a is termed. What I do not clearly understand is get ting the cubic capacity of the cylinders. A. The
length to be added to the length of the card on as shall be equal to the cubic contents of tlearance passages and openings from the valve to the ston when the latter is on its center, or extreme en fthe stroke. If for instance the clearance was 1 inch
nd the stroke 40 inches, then the clearance alone would equal one-fortieth the contents of the cylinder nd if the cubic contents of the passages and openings fom the valve to the cylinder was equal to 1 inc ges would be equal to 2 inches length of che cylinder one-twentieth the capacity of the cylinder will be very difflcult for you to understand the cards
rom a compound engine, except you make the subject
severe stuad or obtain instruction from some one familiar
fards.
(37) J. W. R.a asks: Does the crosshead of
locomotive engine move backward when the engin
is moving ahead, and vice versa $\frac{A}{\text { A. . The erosshead }}$ hever move
wheels slip.
(38) H. W. B.-You may make a fus ble alloy of tin 12 parts, lead 25 , bismutu 50 , cadmium 33, parts by weight, that melts at from $150^{\circ}$ to 180 A fusible alloy may be made of tin 1 part, lead 1 part,
bismuth 2 parts, that melis at 2000. This may be temismuth 2 parts, that melts at $200^{\circ}$. This may be tem pered by adding mercury so as to bring the fusin
point down to 1500 or less. The alloys are conductors
(39) J. L. H. asks bow dry scale can be best separated from steam boilers. A. For removing an eighth of a pound per horse power, and fed to the oiler one day each week, allowing it to remain all ay and then blow off often during the next day, will the boiler should be thoroughly cleaned out, and ex mine angles or corners where deposits might accumu
(40) J. H. S. says: I want to get a tank to pickel beefin, either of zinc or galvanized 1ron, and
would like to know which of them is preferable Would such a tank be injurious to the meat? A. Zin and galvauized iron are not as good for corning o is used, frequent cleaningis necessary. People are fre
se. Stale meat, salt ndwant of cleanliness in the pickle vatare at the bot
om of this trouble; we recommend an oak tank
(41) E. D. C. asks: 1. Can I draiu a pond means of a siphon made of 3 inch gas pipe 1,500 feet ong with an 8 foot fall? A. You can drain the pond, our siphon, which will deliver at best only about 40 gallons per minute. With a siphon the decreasing evel in the pond would gradually lessen the flow. 2 distance that a pond can be drained under a given fall with a siphon? A. Rule for flow: Divide the const or the diameter of pipe under one foot head by the quare root of rate of inclination; the quotient will give he volume in cubic feet per minute. The constant for inch pipe $=73^{\circ} 5$; the constant for 4 inch pipe $=151$ height.
(42) J. A. B. asks: Has the sulptur in the gas any influence on the bath in au open hearth fur-
nace? Have there been any experiments made to invesace? Have there been any experiments made to inve rgate the matter, and if so, by whom, and whee to keep the furnace as free from sulphur as possi e, although probably a emall percentage may no ffect the iron. This can be ascertained by a trial, the visible effect of which is to make the iron hot short, or brittle ata $a$ red heat. The latest and best practice in
iron making is described in various technical journals. iron making is described in various technical journals.
For interestng details you may do well to examine aricles published in Scientific American Supriembe No. 24, Little's process; No. 55, Rees' process; No. 70 71, paper by Dr. Siemens; No. 157, direct cess; No. 364, Bromfeld processs; No. 380, Bulls pro
(43) J. H. L. asks about the process for the manufacture of picture mouldings, gilt and other ay'a person con mouldings. And what book or in what arrying on of such work. A. We have no knowledg any work upon the manufacture of the ornamenta or composition work upon picture frames. They are ade by pressing a comporino of and whiling in
(44) T. M. C. asks who or what is the best athority on the capacity of pipes for delivering water 150 feet head, the pipe bing hif a mile delver, and it much curvature? er under same conditions? A. Neville's Hydrau lic Tables and Formulx is high authority. Your 8 ch pipe will deliver 48 cubic feet per ming
(45) W. S. V.- If it is a real fireproof pain out which you ask, the material constitutug the fire Combustible substances such as asbestos, clay, or pul erized slate or other cheap mineral colors, the resi comal tar being only used in sul
(46) S. \& D. write: We propose erecting ank for windmill pump; tank is to hold 50 barrels, an
to be eleated 30 or 40 feet will you be kin enough to tell us what pressure the tank will supply or water mor, size of connecting pipe 1 inch or 1 1 ch? A. For 30 feet elevation, 13 pounds pressure 40 feet elevation, 1734 pounds pressure.
(47) F. J. S.-For carpenters' tonnage the ale isc Multiply together length, breadu, and depth, nd divide the product by 95 . You will find the va
(48) B.R. N. asks for the mode of rendering orn transparent amber color, like tortoise shell. A fix up an equal quantity of quick lime and red lea with soap lees; lay it on the horn with a small brus in imitation of the mottle of the tortoise shell; when litharge ead tit or three times; or grina ocnce with a sunflicient quantity of liquid salts of tartar to make it of the consistence of paint. Put it on the horn
with a brush in imitation of tortoise shell and in three or four hours it will have produced the desire if not deep enough, it may be repeated. The original
preparation consists in roasting the horn over a fre
made of the stalks of furze; when rendered soft it is slit on one side, and kept expanded flat between a pair
of (tongs it is then placed between iron plates, which re greased. The horns are suffered to remain until they are cooled; they are then soaked in waer enough to epared down to the required thinness, with a large knife worked horizontally on a block. Their trans-
parency is thus acquired
and after being
mmersed in lye, they are polished with whiting and the coal of burnt willow.
Minerals, etc.-Specimens have been re ceived from the following correspondents, and examined, with the results stated:
H. J.L.-The specimen is a hornblendic tock containing pyrites or iron sulphide, a mineral whioh frequently, if not always, carries gold with it. The amount - Dater, ir any, can only be determined by assay. mall that it cannot be easilly delermined without analysis.

INDEX OF INVENTIONS
For which Letters Patent of the United States were Granted
August 5, 1884

## and each bearing that date.


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