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LAUNCH OF THE UNITED STATES TWIN SCREW STEEL CRUISER NEWARK.--[See page 202.]

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$\qquad$ I. BIOGRAPHY-Williai Gilbert, of Colchester:-A review of the

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X. TECHNOLOGY.-A New Indipo Vat.-A new and extremely sim-




I. VETERINARY SCIENCE.-Horseshoes and Roudmass.-A

formal opening of the great forth bridge, Several weeks ago we gave illustrations of this wonderful structure, showing its appearance as completed and opened for traffic. The official or formal opening, which included the clinching of the "last" rivet, took place on March 4, 1890, under the auspices and in presence of royalty, which in England is considered almost indispensable for such an occasion. The Prince of Wales, heir to the throne, accompanied by a large retinue of titled personages, passed by boat under and then by rail over the bridge, inspected its construction and admiredits gigantic proportions. On the return of the royal train a stoppage was made and the Prince alighted ; then, guided by Mr. Arrol, the contractor, the Prince placed his hand on the silver cock of a hydraulic riveter, gave it a turn, and thus bended down the "last" rivet. The train then moved along nearly to the end of the bridge, when his royal highness again climbed to the deck of the bridge, hung on to his hat with both hands, for the wind was blowing great guns, and said, or is said to have said, for nobody could hear him, "Ladies and gentlemen, I now declare the Forth bridge open." Back into the car the Prince quickly placed himself, the gale having nearly sucked away his breath
At the buildings of the bridge works a splendid ban quetfollowed, at which Sir M. W. Thompson presided In reply to the toast in honor of himself and the roya family, the Prince of Wales made an excellent little speech, containing a variety of interesting particular relating to the bridge. We give a brief abstract
"The day has been a most interesting day to all of us, and especially so to me, and I feel very grateful that I have been asked to take part in so interesting and important a ceremony as the one at which we have all assisted. I had the advantage, nearly five and a half years ago, of seeing the Forth bridge at its very commencement, and I always looked forward to the day when I should witness its successful ac complishment. I may, perhaps, say that in open ing bridges I am an old hand. At the request of the Canadian government, I performed the open ing ceremony thirty years ago of opening the
Victoria bridge over the $S t$. Lawrence at Montreal, putting in the last rivet, the total of rivet being one million. To-day I have performed a sim ilar ceremony for the Forth bridge, but on thi occasion the rivets number nearly eight millions in stead of one million. The construction of the bridge has been on the cantilever principle, which has of it may be seen likewise in Japan, Tibet, and the of it may be seen likewise in Japan, Tibet, and the
northwest provinces of India. Work of this descrip tion has hitherto been carried out on small dimensions but in this case the engineers have had to construct a bridge in thirty fathoms of water, at the height of 150 ft. above high water mark, and crossing two channels, each one-third of a mile in width. Had it not been for the intervening island of Inchgarvie, the project would have been impracticable. It may perhaps interest you truction of the figure It the of a mile, and the actual length of the cantilever portion of the bridge is one mile and twenty yards. The weight of steel in it amounts to 51,000 tons, and the extreme height of the steel structure above mean wate level is over 370 ft ., above the bottom of the deepes foundation 452 ft ., while the rail level above high wate is $1561 / 2 \mathrm{ft}$. Allowance has heen made for contraction and expansion and for changes of temperature to th extent of 1 in . per 100 ft . over the whole bridge. Th wind pressure provided for is 56 lb . on each square foot of area, amounting in the aggregate to about 7,700 ton of lateral pressure on the cantilever portion of the bridge. About 25 acres of surface will have to be painted with three coats of paint. As I have said, about eight millions of rivets have been used in the bridge, and forty-two miles of bent plates used in the tubes, abou the distance between Edinburgh and Glasgow. Two million pounds have been spent on the site in building the foundations and piers; in the erection of the super structure ; on labor in the preparation of steel, granit nasonry, timber, and concrete ; on tools, cranes, drills two and a half millions has been the entire cost of the structure, of which $£ 800,000$-nearly one-third o this amount-has been expended on plant and general charges. These figures will give you som idea of the magnitude of the work, and will as those connected with it must have unxiety which a works were commenced in A pril, 1883, and it is highly to the credit of every one engaged in the operation that a structure so stupendous and so exceptional in its character should have been completed within seven years. The opening of the bridge must neces arily produce important results and changes in the railway service' of the east coast of Scotland, and it will, above all, place the valuable manufacturing and mineral-producing district of Fife in immediate communication with the south side of the Firth of Forth. When the Glenfarg line, now nearly completed, is
opened for traffic, the distance between Edinburgh and Perth will be reduced from sixty-nine to forty seven miles, and instead of the journey occupying, as at present, two hours and twenty minutes, an express will be able to do it in an hour. Dundee, likewise, will be brought to within fifty-nine miles of Edinburgh, and Aberdeen 130 miles, and no sea ferries will have to be crossed. The construction of the bridge is due to the enterprise of four important railway companies, (1) North Britishthe bridge is in its district - (2) North-Eastern (3) Midland, and (4) Great Northern, and the design is that of two most eminent engineers, Sir John Fowler and Mr. Benjamin Baker. The contractor was Mr Williain Arrol, and the present Tay bridge and bridge which I have inaugurated to-day will be lasting monu ments of his skill, resources, and energy. I have much pleasure in stating that on the recommendation of the pime minister, the Queen has been pleased to create Mr. Matthew William Thompson, chairman of the Forth Bridge Company and of the Midland Railway Company, and Sir John Fowler, engineer-in-chief of the Forth bridge, baronets of the United Kingdom The Queen has also created, or intends to create, Mr. Benjainin Baker-Sir John Fowler's colleagueKnight Commander of the Order of St. Michael and St. George ; and to confer on Mr. William Arrol, the contractor, the honor of a knighthood.'

## ROLLER MILL PATENT CASE.

A patent suit of considerable importance, relating to roller mills for grinding flour, has lately been decided by Judge Blodgett in the United States Circuit Court or the Northern District of Illinois.
This was a suit brought by the combination known as Patent Roller Mill Trust, but legally styled the Consolidated Roller Mill Company. These plaintiffs hold several patents, among them the Gray \& Odel patents pertaining to adjustments of roller mill rolls, and if their patents could be sustained, they would vir tually enjoy the right of collecting royalty from nearly all users of roller mills, since nearly all employ adjust ments such as are claimed under the patents.
The plaintiffs had obtained a judgment in their favor in May last, in the Eastern District of Michigan, and it was with great reluctance that Judge Blodgett found himself unable to agree with that decision. It, how ever, appeared that previous to this favorable decision another decision adverse to the plaintiffs had been given in the Western District of Wisconsin; which atter Judge Blodgett held to be equally as good as the Michigan case. After a most careful consideration of the premises, Judge Blodgett found the plaintiffs were not entitled to any broad claim for their devices were not entitled to any broad claim for their devices,
and dismissed the bill. If this decision is sustained by the Supreme Court of the United States, it will giv reat satisfaction to the roller mill people in all part of the country, as it will relieve them from royalty payments amounting in the aggregate to very large sums.

## POSITION OF THE PLANETS FOR APRIL

## uranus

s morning star until the 14 th , and then becom ning star. Uranus comes to the front on the Apri planetary record, for the most important epoch in his course, his opposition with the sun, occurs on the 14th at midday. He is then at his nearest point to the earth, and is visible to the naked eye. He must be looked for on the 14 th in the southeast about $3^{\circ}$ east of Spica and $1^{\circ} 36^{\prime}$ farther north. He rises when in op position at sunset, and is on the meridian at midnight An opera glass will be an aid in finding the planet, un ess the visual power is unusually good, and 9 o'clock in the evening is a favorable time for observation
Uranus rises on the 1 st at 7 h .20 m . P. M. On the 30th he sets at 4 h .19 m . A. M. His diameter on the 1st is $3^{\prime \prime} .8$, and he is in the constellation Virgo.

## saturn

is evening star. His vicinity to Regulus and his con venient position for observation make him, during April, the most interesting member of the brotherhood. After his conjunction with Regulus, on March 28th, he continues to retrograde or move westward until the 28th, when he becomes stationary, then, changing his course, or moving eastward, he again approaches the bright star, being nearly $1^{\circ}$ west and $1^{\circ} 36^{\prime}$ north of it at the close of the month
Saturn sets on the 1st at 4 h .7 m . A. M. On the 30 th he sets at 2 h .11 m . A. M. His diameter on the 1 st is $18^{\prime \prime} .4$, and he is in the constellation Leo.

## mercury

is morning star until the 9th, and then evening star. He is in superior conjunction with the sun on the 9 th, at 2 h .22 m. A. M., and commences his swift course eastward from the sun, overtaking Venus on the 25th. The two planets are then in conjunction at 11 h .10 m . P. M., Mercury being $2^{\prime} 4^{\prime}$ north. As the planets set about an hour and a half after the sun on the 25 th, and are in high northern declination, sbarp-sighted observers may and them soon after

Mercury rises on the 1 st at $5 \mathrm{~h} .33 \mathrm{~m} . \mathrm{A} . \mathrm{M}$. On the 30 th he sets at 8 h .35 m. P. M. His diameter on the 1 st is $5^{\prime \prime}$, and he is in the constellation Pisces.

## mars

is morning star, and his movements increase in import ance as he approaches opposition. He may be readily recognized in the southeast as a red star of the first magnitude, rising about 11 o'elock on the 1st of the month and at half past 9 o'clock at its close. Southern observers will see him in his best estate, but he is unfavorably situated for observers in this latitude on account of his great southern declination.
Mars rises on the 1 st at $11 \mathrm{~h} .10 \mathrm{~m} . \mathrm{P} . \mathrm{M}$. On the 30 th he rises at 9 h .30 m. P. M. His diameter on the 1 st is $12^{\prime \prime} .6$, and he is in the constellation Scorpio.

## JUPITER.

is morning star. There is no need of pointing him out to the observer who has an outlook on the southeastern sky, for at 3 o'clock on the 1st, and soon after 1 o'clock on the last of the month, he will loom above the horizon and shine with superb brilliancy.
Jupiter rises on the 1 st at 3 h .1 m. A. M. On the 30th he rises at $1 \mathrm{~h} .18 \mathrm{~m} . A$. M. His diameter on the 1 st is $34^{\prime \prime} .2$, and he is in the constellation Capricornus. venus
is evening star. She will soon emerge from her temporary eclipse in the sunbeams, and prove her claim to be the brightest star in the firmment. She sets an hour and a half after the sun at the close of the month.
Venus sets on the 1 st at 7 h .8 m. P. M. On the 30 th she sets at 8 h .19 m. P. M. Her diameter on the 1 st is $10^{\prime \prime} .2$, and she is in the constellation Pisces.
neptune
is evening star. He sets on the 1 st at 10 h .28 m. P. M. On the 30 th he sets at 8 h .38 m. P. M. His diameter on the 1st is $2^{\prime \prime} .5$, and he is in the constellation Taurus. Mercury, Venus, Neptune, Saturn, and Uranus are evening stars at the close of the month. Mars and Jupiter are morning stars.

Electrical Calculations.-II.
t. o'conor sloane, ph.d.

We have seen how to calculate the minimum number of cells of any given battery to supply a specified current through a specified resistance. This is what we termed case $a$. The next thing to be determined is what number of cells should be used to give a fair economy in the consumption of zinc and chemicals. This we have called case $b$.
Where the resistance of the battery is equal to that of the outer circuit, 50 per cent of the energy will be wasted in overcoming the resistance of the battery. If the battery has one-fourth the resistance of the outer circuit, only 20 per cent of energy will be wasted. This may be taken as a fair ecunomy, and the calculations for such a battery are the following :
Divide the resistance of the outer circuit by 4 ; this gives the proper resistance of the battery. Multiply the resistance of the outer circuit by the current to be maintained, and increase the product by one-fourth of
itself; this gives the proper E. M. F. of the battery. The cells are then to be arranged to develop these quantities, as follows :
Enough cells are put in series to give the E. M. F. called for. This number is then multiplied by the known resistance of a single cell, and the product is divided by the proper resistance of the battery. The quotient is the number of cells to be put in parallel.
Assume as before that on the outer circuit a current of $31 / 3$ amperes has to be supplied through a resistance of 30 ohms. Assume a battery, one cell of which has an E. M. F. of 2 volts and resistance of 1 ohm . Following the rule just given, divide 30 by 4 , giving $71 / 2$ ohms as
the final battery resistance. Next multiply 30 by $31 / 3$, giving 100 , and increase this by $\frac{100}{4}=25$, giving 125 volts as the final E. M. F. of our battery. To develop this voltage, $\frac{125}{2}$ cells are needed in series, giving $621 / 2$ cells, or say 63 cells. Multiplying this number by 1 ohm, the resistance of a single cell, and dividing by the final battery resistance, $71 / 2 \mathrm{ohms}$, we have 8.4 cells in parallel $\left(\frac{63 \times 1}{71 / 2}=8 \cdot 4\right)$. Therefore we put 9 cells in parallel, as wherever a relatively small fraction of a
cell is called for, it is well to put in an excess. Our total cells, therefore, are $9 \times 63=567$ cells. As combined the E. M. F. is 125 volts, the resistance is 7 ohms. Applying Ohm's law to prove our work, we have $\mathrm{C}=\frac{\mathrm{E}}{\mathrm{R}+R^{\prime}}$
or $\frac{125}{}=3.4$ amper or $-\frac{125}{30+7}=3.4$ amperes nearly, or a slight excess of
current.
This seems a large number of cells, but economical

This seems a large number of cells, but economical results cannot be attained with a small quantity of
high resistance cells. We may, to illustrate this fact, apply these calculations to two other batteries, assum ing the same outer circuit constants in both cases.
Let one high resistance battery have the following cell constants : $e=1$ volt; $r=3$ ohms. To develop the 125 volts called for, 125 cells in series are needed.

To reduce the resistance to $71 / 2$ ohms, we need 50 cells in parallel, $\left(\frac{125 \times 3}{71 / 2}=50\right)$ giving a total of 6,250 cells.
Let the other battery have the following constants $e=2$ volts; $r=1 / 4 \mathrm{ohm}$. 'To develop 125 volts, 63 cells in series are needed. To give $71 / 2$ ohms resistance we need 2 cells $\left(\frac{63 \times 1 / 4}{71 / 2}=2\right)$ in parallel, giving a total of only 126 cells.
This shows the importance of a low resistance ratio compared to voltage. Practically, a high resistance battery cannot be used for heavy work. Low resistance may even compensate for low voltage, as in the oxide of copper-caustic soda battery.
Taking a battery of the constants, $e=2$ volts, $r=$ $\frac{1}{1}$ ohm, it will be found that $11 / 4$ cells are needed in s ohm, it will the found conditions. As this is impossi-
parallel for the above cond parallel for the above conditions. As this is impossi-
ble, and as the fraction is relatively too large to neglect, the best plan in such a case is to take the next highest integral number for the cells in parallel and reduce the number of cells in series. Thus, instead of $11 / 4$ cells, take 2 cells in parallel, and calculate the constants of
such group. They are in this case $e=2$ volts, $r=$ such group. They are in this case $e=2$ volts, $r=$ 110 hm . Applying the rule given in the former
we have : Number of groups $=\frac{\mathrm{C} \mathrm{R}}{-\mathrm{C} r}$ or $\frac{31 / 3 \times 30}{2}$ 58 cells in series and 2 in parallel, a total of 116 cells Applying Ohm's law to test our work, we have $\mathrm{C}=\frac{116}{30+4.8}=3.3$ amperes. The economy in chemi cals and zinc is increased by this procedure,
energy being only $\frac{4 \cdot 8}{34 \cdot 8}$ or about 14 per cent.

## New Method of Determining whether Cesspools

 by prof. lucien i. blake, university of kansas.The present paper has been prepared with a view of describing a simple and inexpensive method of deter mining whether stables, privies, cesspools, or any other deposits of filth, which may lie in the immediate neighborhood of a well, drain into it. In a common porous soil surface filth in solution may quite readily penetrate to underground water, and thus in the course of time travel a considerable distance and reach a well quite remote. This fact is well known. But it is always un certain how far and in what direction such travel may extend. The varying circumstances of soil, slope of
surface and of rock, depth of well, etc., preclude any surface and o

The eye and the sense of taste form no reliable test ing instruments, for the clearest, most tasteless, or most sparkling well waters may yet be solutions of the thus contain the germs of dreaded diseases. Severa methods have been tried, from time to time, to trace sources of pollution in wells. A solution of aniline dyes has been poured into such suspected sources, and fter a few days the wall water has been examined by the eye for its color. But the eye is only slightly sensi
tive to a weak solution. tive to a weak solution
Again, a half bushel or so of salt has been thrown into the filthy places, and the sense of taste called in to detect its presence in the well water, or the water has been analyzed for chlorine. $\dagger$ But the amount of salt required, and the unreliability of the sense of taste, $\ddagger$ and the expense of chemical analysis render the method unsatisfactory. I am not a ware of any process which seems simple, inexpensive, and reliable. Chemical analysis will detect the presence of polluting mat ter, and thus indirectly suggest its source. But such an analysis requires an expert.
It occurred to the writer to make use of the spectro scope in testing, and the following method of search for sources of pollution in various wells scattered abou the city of Lawrence was developed.
It is familiar to all that a glass prism will separate a ray of sunlight into the seven colors of the spectrum. If the ray comes from a metal which is vaporized in trum no longer consists of all the colors, but of one or more bright bands, characterized by their color and position in the spectrum
Thus sodium gives a bright yellow band, which is in the position of the yellow of the Swiss spectrum, while calcium gives two, a red and green band, in their proper places. The spectroscope, which is essentially a glass prism and a small telescope to observe the spectrum with, can thus detect by their characteristic bands the presence of su
Further, there can be no mistake, for no two metals give the same bands. The question arises, Can small quantities of the substances in solutions be thus detect d? Prof. Schellen asserts the sure and easy determina tion of sodium, when less than the $180,000,000$ part of grain is present, and of lithium when less than the $40,000,000$ part of a grain. The delicacy of the spectro-
scopic tests thus exceeds the chemical. Indeed, by the scopic tests thus exceeds the chemical. Indeed, by th

* Read before Kansas State Sanitary Association
+ See " Water Supply "W. H. Nisole
$\dagger$ See "Water Supply," W. H. Nichols, p. 132.
Bailey and E. L. Nichols.
spectroscope several new metals, as thallium, rubidium, caesium, and iridium, have been discovered. For the purpose on hand, then, the spectroscope provides an exceedingly simple method.

A solution of carbonate or chloride of lithium, an ounce to a quart of water, was poured into the suspected sources of pollution in the neighboriood of a well, and after a week or so some of the well water wasexamined in the spectroscope. Lithium gives one bright red band toward the remote red end of the spectrum. It is impossible to mistake it, even if the solution holds less than one part in one million. The sensitiveness of the test is greatly increased by boiling down the water to be examined, say a quart to half an ounce. A platinum wire is dipped into the water thus prepared, and then held in the flame of a Bunsen burner.
Nine wells were examined situated back of the blocks on the principal street in Lawrence. These wells are located, as regards stables, outhouses, etc., about as is customary in small cities, and their waters are used quite generally for drinking purposes by the families in the blocks. The test showed direct communication with a privy 30 feet distant into one of the wells. Other wells are now being tested more thoroughly, as the method was devised too recently to allow sufficient time in a four months' absence of rain for the lithiated water to permeate through the dry soil to the wells. But sufficient has been done, it seems, to show the reliability of the method and the ease of making it.

Physical Laboratory, State University of Kansas,
February, 1890.

## Short-sighted Inventors.

A few months ago an inventor of certain apparatus of a very simple character, which could have been readily duplicated in many different forms, was offered $\$ 6,000$ for the right to a certain inland town. He was a poor man and needed the money badly. The reader supposes, of course, that the inventor jum ped at the chance and pocketed the money on the spot. Not he; he told the buyer that the patent was worth $\$ 100,000$, and he was not going to sell one town in New York State for $\$ 6,000$. The same inventor was offered a similar sum or another large town in the State, or $\$ 10,000$ for only wo cities in the country, but he refused to take it We have these facts from the inventor himself, and hey are correct. Before it was too late to negotiate, we berated the man soundly for his folly, but he was deaf to all argument. The sequel was that the inven tor never sold a single right, and has his patent to this tor ne
day.
The

The fatuity of inventors on this one point, the value of their patents, is wholly incomprehensible from a business point of view. If a farmer was offered $\$ 10,000$ for ten bushels of potatoes, and refused it upon the ground that the bushels would produce tons of pota toes, he would be no more inconsistent than the inventor who refuses a good round sum of money for an unmarketed invention. Yet this is what they do every day in the year. There are men walking the streets in poverty who have devices of more or less value, which, in the hands of business men, would have commercial value, that they refuse to part with because they are not paid highly enough in their own estimation. Let inventors remember, for their own good, that an undeveloped, unmarketed invention is of no more value than the paper the patent is written on. It has possibilities, no doubt, but these last are intangible, and before they can be converted into dollars and cents another head must be called in, and as his risks are greater than the inventor's, he must have an adequate reward. Every patent of any prospective value, even, has to be litigated sooner or later, and this costs money; is value is not established until the absolute priority of the patent is settled. If inventors would only bear these facts in mind, and sell theirinventions as soon as possible, there would be fewer disappointed patentees. [The above from The Engineer is good advice, and worth heeding by patentees. Similar incidents to the one related have frequently come to our knowledge, and while it may not be wise to accept the first offer the patentee of a valuable invention has for his patent, it often happens that a better price can be had for a patent when it is fresh from the Patent Office than afterward.-Ed.]

Wool Burring in Australia.
The Illustrated Sydney News states that one of the wool companies there has a burring machine recently imported from America which effectually eradicates all burrs and other extraneous matter from sheep skins, and its work is done in the most complete manner; skins thickly matted with burr and seed are put through this machine and turned out clean and free, without doing the slightest injury to the wool, while its value is materially enhanced. This is a great acquisition to the company in their fell-mongering department. enabling them to treat the very worst class of skins in a complete and satisfactory manner. There is also connected with these works a tannery on an extensive scale, where from 200 dozen pelts per week are converted into basils of a high class, for which there is a ready market.

THE MANUFACTURE OF FISHING RODS AND TACKLE We present some views in the factory of Thomas H. Chubb, at Post Mills, Vermont, a factory of special in terest to sportsmen as well as mechanics, as being or ganized for the production of a single line of products, the highest grade of fishing rods and of anglers' re quirements in general.

The history of its establishment is characteristic. Mr Chubb, by birth a Southerner, cane north to the hills of Vermont in search of health. He first erected a factory for the construction of wooden rakes. As this factory for the construction of wooden rakes. As this
business did not succeed, he substituted for it the


## EIGHT-STRIP SPLIT BAMBOO ROD AND LEATHER CASE.

chinery was available, and early in 1869 he began active operations in this branch of work. The business increased, and eventually some fifty men were employed when in 1875 the factory was destroyed by fire. The present building was at once erected, three stories and a basement in height, covering an area of $120 \times 32$ feet with an addition of $30 \times 24$ feet.
The factory is situated on the banks of the 0 m pompanoosuc River. Near it is Fairlee Lake, a pictur esque sheet of water, some three miles long, which is well stocked with fish. The river supplies water power, all the machinery in the factory being driven by a turbine, a steam engine and boiler being held in re serve in case of accident to the water works.
A large amount of special machinery, much of which A large amount of special machinery, much of which
was designed by Mr. Chubb himself, is used in the pro-
ing a joint, so that when finished the rod has a hexa gonal or octagonal section. This very ingenious method of treating the material gives the rod a strength lasticity, and feel unapproachable in any other way The bamboos imported come in bundles of fifty pieces. They are from 16 to 20 feet long and their butts var from 1 to $11 / 2$ inches in diameter. In the grade of rod nade for the retail trade, only four or five pieces in nany instances can be secured from a whole bundle.
After being properly shaped by splitting and other processes, the lengths have to be cemented together either six or eight in number, according to the rod which is to be made. The pieces are put together and held firmly in position until thoroughly satur ated with cement. The are firmly bound with linen thread, a special machine being used for this purpose, and then they are put away to dry. Three months drying at a natural tem perature is used. A very light sandpapering and polishing is next ap plied. Any cement on the outside is removed also and great care is taken in conducting these operations not to impair the natural namel.
Two other kinds of wood are used besides the bam boo-lancewood and greenhart. These woods are not used immediately, but are stored for two years in order to insure thorough seasoning. The rods made from these materials stand next in value to the split bamboo, but their manufacture does not involve the steps we have just described as being followed in the split ods.
In the finishing of this class of rods they are polish ed with pumice stone, their pores are filled with whit ing and water, and they are shellacked and varnishect In some cases five or six coats are given before the fina In some cases five or six coats are given before the final
finish. When the rods are completed, each one is test-
casting brasswork used on rods and for reels. In the finishing shop, already spoken of, the brasswork is completed. It contains lathes for the work upon ferrules, reels, funnel tops, etc. Here the brasswork is turned out ready for use, and here also it is fitted to the different sections of the rods. The finest kind of reels, with other accessories, are manufactured in the ame factory
Within the limits of our space it will be impossible to give the most cursory description of the great vari ety of rods made in the Chubb factory. The 8-strip salmon bamboo rod is a good representative. It is 16 feet long and weighs 26 ounces. It is supplied with two tips; the ferrules are re-enforced, so that no water can ever reach the wood. The Chubb waterproof varnish

a good piece of bamboo.


A POOR PIECE OF BAMBOO. used on all the rods protects their exteriors perfectly This represents posite extreme, the "Raymond" fly rod may be taken. It is 9 feet long and weighs only 4 ounces. It is of so fine a grade that six and seven pound trout have been caught with it. In making the higher qualities of rods the ideas of representative anglers have been utilized, and the rods in some cases are made from them.
Among the reels, the Henshall 4 multiplier reel stands


SPLIT BAMBOO ROOM.


MACHINE SHOP.
cess of manufacture, and some idea of the appearance
of the work rooms can be derived from the three view which we give, representing respectively the shop, where the heaviest machinery is employed turnshop, where the heaviest machinery is mployed rom-
ing out the metal work, etc., the split bamboo room, where the cane is treated, and the finishing room, devoted to work in wood and in metal.
Three kinds of wood are used in the manufacture; bamboo, imported from Calcutta, is one of the greatest favorites. Our readers are all familiar with the peculiar distribution of fiber in the cane; the outside is coated with a hard enamel, within which fibrous layer. The elasticity and strength of the rod are largely derived from the enamel or outer coating, which has a depth of about 1-16 of an inch. The fibrous material acts as a backing for this portion.

To show the difference between the good quality of highly fibrous bamboo and the poor quality, two illustrations are given, which speak for themselves. The problem now is to construct a rod out of bamboo in which the outer coating alone can be utilized as a vital element. This problem is solved by splitting the bamboo, the direction of the splits following the natural grain, and building up the rod from these pieces. Only the butts are used in the preparation of these split pieces, which have a length varying from three to four feet. They are then accurately shaped, so as to go together somewhat like the staves of a barrel. The outside or enameled part is hardly touched, the natural finish of the wood being carefully preserved.

Either six or eight pieces are used in mak-

finishing room.
perhaps the highest. It is made of German silver of the best quality, with steel gear and pivots throughout. It can be made to multiply either two or four times. It has a mechanical thumb drag, or brake, placed upon the plate opposite the handle, thus being well out upon the plate opposite the handle, thus being well out
of the way of the latter when rotating. It has also an of the way of the latter when rotating. It has also an
adjustable drag and adjustable click, so that any desired operation can be given to it. It holds 100 yards of fine line. The reel when started will run for a minute and a hailf to two minutes, its balance and journaling is so perfect.
Among the other accessories made or supplied by the Chubb factory may be mentioned fly books, cases for rods, landing nets with jointed frames, reel cases, and the highest grade of frames, reel cases, and the highest grade of
silkworm gut, fishing lines, varnish and stain silkworm gut, fishing lines, varnish and stain
for rods, etc. For those who prefer to make for rods, etc. For those who prefer to make
their own rods, stock is supplied to satisfy every requirement. A very convenient appliance is the fishing rod holder. It is made of malleable iron, with a clamp arranged for screwing to the seat or thwart of a boat. The swivel joint at the top and at the base of the standard, with their axes at right angles to each other, constitute a universal joint in their combined operation, so that the rod can be set to any angle desired. By means of these holders two or more rods may be worked by a single fisherman.
Hooks and flies, made to Mr. Chubb's order, of the very highest grade, are also supplied. In the machinery used and in the products which are manufactured, much patented work is embodied. Many of these patents were taken out by the Scientific American agency.

A HANGER FOR USE IN CURING TOBACCO.
The accompanying illustration represents an improved hanger or stick for use in curing tobacco in the leaf in barns and elsewhere, by heat. It has been patented by Mr. Burton B. Edwards, of Marshall, N. C. Each hanger is composed of two wooden side pieces, preferably about 31, feet in length, $3 / 8$ inch thick, and $11 / 2$ inch wide, held together in inverted V -shape by


## EDWARDS' TOBACCO HANGER OR STICK.

transrerse spring clamps arranged at suitable distances apart, three such clamps being ordinarily sufficient, although four clamps may be used with a hanger five feet long. These springs may be made of either stee or hard brass, in the latter case being preferably stamped out of a single piece, or if made of steel being formed as shown in the upper part of the illustration, by a narrow band of thin metal, bent upon itself to form side pockets for the wooden strips, which are thus held to pinch at their meeting edges. The leaves when suspended for curing are clamped between these meeting edges, so that the metal does not come in contact with the tobacco, and the device may be readily taken into the field for filling to facilitate the commencement of the curing as soon as the ground leaves begin to ripen, so that by the time it is usual to cut the tobacco, the whole crop may have been gotten out of the way. The inverted V-shape of the stick allows the heat to concentrate or accumulate, so as to cure the butts of the leaves as fast as the bodies of the leaves The sticks may be taken separately to the field and put together as needed, the spring clamps being fitted so as to be readily slipped on and off the wooden strips, this facility of putting the stick together and taking it apart being also of great advantage as regards ship ping and storing the sticks.
For further information relative to this invention address the Piedmont Tobacco Stick Company, Mar shall, N. C.

AN IMPROVED ADJUSTABLE GROOVING HEAD.
An adjustable dado or grooving head, capable of at tachment to any saw, mandrel, or arbor, and by which, without removing the cutters, the width of the groove to be cut may be varied, has been patented by Messrs. Francis I. Matthews and Daniel J. Quinlean, of Liver more, Cal, The head has perfectly smooth side faces whereby adjustment may be made upon either side as may be found convenient, and the device will oc


MATTHEWS \& QUINLEAN'S ADJUSTABLE GROOVING HEAD
cupy no more space upon the arbor when expanded to its greatest extent than when in position to cut the narrowest groove. The illustration herewith represents a form of grooving head or dado which they make, styled the "Chief," the small figures showing different forms of knives and the key employed in fixing them in place. By their recently patented invention the carrier blocks are held to place by a bev
eled clamping block fitting in a recess in the periphery of the head, a set or cap screw passing through this block into a threaded cavity in the base wall of the recess. Adjusting screws are also provided, by turning which the carrier blocks with their attachments will be moved laterally in opposite directions, thus producing a narrow or a wide groove. The adjusting screw is preferably given about sixteen threads to the inch, so that one turn of the screw will move the knife or cutter about one-sixteenth of an inch, and a graduat ing circle is produced on the head around the adjusting screw, which, in connection with a line across the center of the screw head, will enable the operator always to regulate the adjustment to a small fraction of an inch.

## AN IMPROVED CAR COUPLING.

The coupler shown herewith is designed for use also with a link and pin drawhead, and to be operated from the sides or top of the car. It has been patented by Mr. Morgan D. Kalbach, of Harrisburg, Pa. Fig. 1 shows the device in perspective, Figs. 2 and 3 being vertical and horizontal sections through the drawhead Within the opening of the drawhead are pivoted two knuckles, whose outer ends extend beyond the front of the drawhead. One knuckle has two leaves and the other a single leaf at the pivotal point, the single leaf of one knuckle passing between the two leaves of the other. At the rear of the knuckles a locking block is held to slide, the block having at its rear end a slot, through which passes the crank arm of a rock shaft the latter extending out through openings in the draw head, and the upper extremities of its end projection


## KALBACH'S CAR COUPLING

being weighted, while a crank arm is also extended from the rock shaft for manipulation at the side of the car being likewise connected by a rod with the top of the car. Upon the top of the drawhead, at one side, is cen trally pivoted a lever, which is connected at one end by a link with a sliding spring-held latch located in a hori zontal chamber in the drawhead, the lever being con nected at its other end by a link with one of the knuckles. The opposite knuckle has an opening from p to bottom for the reception of a coupling pin, and a horizontal recess, in order that a link may be mployed, the other knuckle also having a simi lar horizontal recess produced therein. To set the drawhead to couple with an opposed coupler, it is only necessary to press down upon the crank arm at the side or from the top of the car, whereupon the latch is operated to work a lever to force the outer ends of the knuckles apart. Upon contact with the knuckle of an opposed drawhead, the latch is forced inward and the knuckles are made to approach one another, while the locking blook is forced between the inner ends of the knuckles, preventing the opening of their forward ends to the unlocked position.

A Gas Holder without Framing.
In our Supplement, No. 668, we described a gas holder in whose construction it was proposed to dispense with the guide frame invariably used hitherto. Spiral tracks or ways were to be provided inside of the tank, along which rollers attached to the lower circles of the onter section traveled, while similar ways were to be arranged inside of the outer sections. The plan seemed a bold innovation, but has recently been put into practice. In Northwich, England, a holder con structed on this principle, the invention of Messrs. William Gadd \& W. F. Mason, was inaugurated some weeks ago. It has a capacity of 109,000 cubic feet, is 58 feet in diameter, and 40 feet high in two lifts. Thi s large enough to give a thoroughly practical test, and the future history of the holder will be watched for with interest.

THE law compels no one to do impossibilities.

## AN IMPROVED DOOR KNOB ATTACHMENT.

A simple means of attaching door knobs to square pindles, the attachment being easily adjusted to a door of any thickness, and suitable for any kind of nob, is illustrated herewith, and forms the subject of patent issued to Mr. Sawuel H. Berrey, of No. 100 Pavilion Avenue, South Providence, R. I. Fig. 1 is a side view showing the application of the improvement, Fig. 2 being a longitudinal section of one end of the


BERREY'S DOOR KNOB ATTACHMENT.
lock spindle where it is attached to one knob, and Fig. 3 a transverse section, showing the spring-actuater tumblers and pins engaged with the holes in the lock spindle. The shank of one door knob is attached in the usual manner to the lock spindle, the other end of which has a series of holes, and upon this end the shank of the other knob is made to slide and is adjusta bly attached. For this purpose the second shank ha an annular chamber, to one, side of which are pivoted two tumblers fitting closely around the lock spindle, as shown in Fig. 3, and each having a pin which fits into opposite sides of the holes of the lock spindle, the tumblers and pins being retained in locked position by a spring. The free ends of the tumblers are rounded, and opposite these ends is a wedge whose outer face has a shank projecting to the outside of the shank of the door knob, so that by pressing on the shank the wedge will be forced between the rounded ends of the tumblers, throwing them apart and leaving the knob free to slide on the lock spindle. A spring washer incloses one of the door knob shanks, to take up any slack there may be in the parts and insure a perfect fit on the door.

## AN IMPROVED DOOR CHECK.

A device whereby a door or gate may be held open at any desired angle, or retained closed if necessary, is shown in the accompanying illustration, and has been patented by Mr. Samuel J. Dohrmann, of No. 402 West Main Street, Louisville, Ky. Fig. 2 shows the device applied to a door, Fig. 1 being an en larged edge view. The check or stop consists of two arc-shaped segments pivoted in a bracket secured low down on the door, while near the door lock a disk is pivoted upon a projecting bracket, the disk having a limb or crank handle at its periphery. To this disk is fastened a chain, which is connected at its lower end with two short chains attached to the curved


DOHRMANN'S DOOR CHECK
rims of the segments. By moving the handle upward, to give the crank disk near the lock a partial revolution, the lower corners of the seginents are swung downward, as shown in dotted lines, to engage the floor surface, and prevent the movement of the door in either direction. The segments may also be lowered when the door is closed, when they serve as a lock to prevent the opening of the door until they are raised.

## Railway Shop Industries

Very few visitors to railway shops have any idea of the number of distinct occupations with which the numerous workmen seen are busied. Indeed, we doubt if many of the shop officials and hands themselves realize how many trades and vocations are represented among their co-workers. The following list of actual workers at the shops of a large Eastern road, copied from a blank of that road, will prove not only interesting but surprising to a good many of our readers :

| Master mechanics. |  |
| :---: | :---: |
| Foreman car repairs. General foremen. |  |
|  |  |
| Draughtsmen. |  |
| Engineer of tests. |  |
| Inspectors. |  |
| Chemist. |  |
| Chemist assistants. |  |
| Clerks. |  |
| Timekeepers. |  |
| Storekeepers. |  |
| Messengers. |  |
|  | Machinists. |
|  | Boiler maker |
|  | Blacksmith |
|  |  |
|  | Car builders. |
|  | Car cleaners. |

WORKing by the month.


## working bi the hour.

ir brake inspectors and repairers.
$\left\{\begin{array}{l}\text { Blacksmiths. } \\ \text { Boiler maker }\end{array}\right.$
Boiler makers.
Copper and tin smiths.
Car builders.
Machinists.
Moulders.
Painters.
Painters.
Pattern
Pattern makers.
Upholsterers.
Ash pit cleaners.
Blacksmiths.
Blacksmiths' helpe
Boiler makers,
Boiler makers' hel
Boiler washers.
Boiler washers
Bolt makers.
Bolt cutters.
Bricklayers, masons, and slaters.
Bricklayers, masons, and slater
helpers.
Coppersmiths.
Coppersmiths' helpers,
Callers.
Coal and wood heavers.
Carpenter
Car inspectors, passenger
Car inspectors, freight.
Car builders in shop, passenger.
Car builders in shop, freight.
Car repairers in yard, freight. Car cleaners.
Car oilers
Drilters.
Dynamo attendant.
$\left\{\begin{array}{l}\text { Cleaners. } \\ \text { Dumpers. }\end{array}\right.$
Preparers (firing up, etc.
(Inspectors.
Electro replater.
Flue setters.
Flue setters'
Flue setters' helpers.
Flue welders.
Flue cleaners.
Flue cleaners.
Foundrymen $\left\{\begin{array}{l}\text { Core makers. } \\
\text { Cupola men. } \\
\text { Moulders. } \\
\text { Helpers. } \\
\text { Melters and help. }\end{array}\right.$

Gang \begin{tabular}{l}
Garemen of

 

Laborers. <br>
Pits. <br>
Engine house. <br>
Rods, etc.
\end{tabular}

## Copper and tin shop.

\% Machine tools.
范范
Car repair shop, Car repair shop, freight. Engine cleaners.
Painters.
(Planing mill.
Hammersmen.
Hammersmen helpers.
Hammer boys.
Hammer
Heaters.
Hostlers.

| Hostlers. |  |
| :---: | :---: |
| Laborers | ( Machine shop. |
|  | Car shop. |
|  | Paint shop. |
|  | Lumber yard. |
|  | Foundry. |
| Lumber i | nspectors. |
| Machinist |  |
| Machinist | ts' helpers. |

Machine hands, planirg mills. Machine hands, helpers. Machinery oilers.
Messengers.
Nut tappers
Nut tappers.
Pipe fitters, shop
Pipe fitters, water works. Pipe fitters, water works, helpers. Painters.
Painters
Painters' helpers (cleauers, etc.)
Pattern makers.
Smoke stack inspectors.
Stationary engineers.
Stationary engincers.
Stationary firemen.
Shifting brakemen.
Sand driers.
Speed recorder men.
Sheet iron workers (light).
Sheet iron workers' helper
Spring maker.
Tering maker helpers.
Tinsmiths.
Tinsmiths' helpers.
Time keepers.
Turntable men.
Upholsterers.
Watchmen.
Wipers (see
Wipers (see engine cleaners).
Wheel borers.
foremen
Rods, etc.

- Here are 143 different classes of employes recognized on the wages sheet. There are not 143 different trades, for, as will be seen, there are blacksmiths, blacksmiths apprentices and foremen of blacksmiths, and so on, yet after allowing for these duplications the number of distinct trades represented is notable.-Railway Master Mechanic.


## Railroads in South America.

In a recent issue the Chicago Tribune says: "The proposed intercontinental railroad which is to connect North and South America, starting southward from the city of Mexico, is now supplemented by a proposi tion from H. C. Parsons, of Virginia, to build another road, less than 2,000 miles in length, beginuing at Cartagena, on the northern coast of Colombia, thence running south through Ecuador to Cuzco, in Peru, where it will connect with the road already building north ward from the Argentine Confederation. A company has already been formed under a charter from the State of Virginia, and trustees appointed, the latter being. Judge Granville P. Hawes, of New York Ex-Senator T. M. Norwood, of Savannah, Ga.; John W. Thompson, a Washington banker, and A. W. Camp bell, of Wheeling, W. Va. The first step to be taken will be the survey of the route, and for this a fund of $\$ 500,000$ has been raised. Great difficulties will stand in the way, especially among the mountains, as huge peaks will confront the surveyors in Ecuador and Bo-
livia, but in these days of science it is premature to consider anything insurmountable, and the success which has crowned the efforts of the builders of the tunnels will be encouraging to the projectors of the north and south road. The new road, it is claimed, will pass through an exceedingly fertile country to the north, in many sections rich in gold and silver, and abounding in coal and timber. A considerable portion of the road will run through an almost virgin region, very sparsely populated, but once opened up the projectors are certain that its natural resources will attract a large colonization. The country penetrated by the road is one of the most picturesque in the world, and the enthusiastic projectors are confident that within five years it will be the favorite route of tourists, instead of the European. It will, at least, be a new experience when the traveler can purchase his through tickets from New York to Chicago, thence to the city of Mexico, through Central America, and down through of Mexico, through Central America, and down through
the wild scenery of the Andes to the heart of Peru, thence eastwardly through Bolivia, Buenos Ayres and Brazil to Rio Janeiro, and home by steamer to New York. For some time to come it is evident that human enterprise and energy will concentrate themselves upon the great work of opening up Africa and South America, the one to civilization, the other to commerce. England seems destined to accomplish the one, and the United States, if she is quick to seize her opportunities, the other.

## AN IMPROVED BLIND FOR BRIDLES

The accompanying illustration represents a blind designed to be quickly attached to or detached from a bridle of any kind. It has been patented by Mr. Elias Lindblom, of Biggsville, Ill. Each blind has the usual


LINDBLOM'S BLIND FOR BRIDLES.
flap, on one side of which is a strap extending a short dis tance beyond the upper edge of the flap, and having an aperture near its outer end to receive the tongue of a buckle before the side strap of the bridle is secured on the buckle. In the same side of the flap of the blind is also formed an opening adapted to receive a short strap having a buckle on one end, this strap holding the bridle strap and the strap attached to the bit ring in position against the edge of the blind. When the blind is to be against the edge of the blind. When the blind is to be
attached to the bridle, the aperture in the strap extendattached to the bridle, the aperture in the strap extend-
ing beyond the edge of the blind is passed over the tongue of the buckle on the strap attached to the bit ring, the bridle strap being then secured to the same buckle in the usual way, after which both straps are secured in position against the edge of the short strap secured to the latter.

## Medicated Liquid Soaps.

In a paper read before the recent congress of Russian Pharmaceutical Societies, Herr Saidemann called at tention to the therapeutic value of liquid soaps, which he claimed to present the advantages of being more suitable for inunction, favoring admixture of medicinal substances, and being always producible from vegetable oils, thus avoiding the use of animal fats (Phar. Zeit Russl., Dec. 24, p. 820). The formula recommended by him for a liquid soap is to mix 1 part of caustic potash dissolved in an equal weight of water with 4 parts of olive oil and one-fourth part of alcohol, and shake it vigorously during ten minutes. The mixture is repeat edly stirred during the next hour, then mixed with an equal quantity of water, and after standing severa days filtered.
The author states that carbolic acid incorporated with a potash soap has its caustic and poisonous properties paralyzed, while its disinfectant action appears to be ncreased. It is also stated that the Berlin District Sanitary Commission has found a solution of potash soap in 10,000 of water completely to prevent the de velopment of the splenic fever bacillus, and has recom mended a solution of 15 parts in 10,000 as one of the best disinfectants.

THE maker of an accommodation note is bound to
all other parties as if there were a good consideration.

## A Story of Early Petroleum Days.

Quincy Robinson related an incident of the early history of the oil regions recently, which may give the children of the present generation a vague idea of the magnitude of the transactions which took place when oil was $\$ 8$ and $\$ 9$ a barrel, and poor people gained a competency by scooping it off the surface of creeks, or competency by scooping it off the surface of creeks, or
gathered it from pools around the tanks which had overflowed. The story as told by Mr. Robinson was as follows:
" Within a month after Colonel Drake had struck the first petroleum ever brought to the surface in America by means of drilling, my father and the father of my relatives here bought a tract of land comprising 1,280 acres, adjoining the farm on which the Drake well was located, for $\$ 350,000$. Not long afterward I was sitting in their office one day-I remember it as distinctly as though it happened only yesterday-when an agent for an Eastern syndicate walked in and offer ed $\$ 500,000$ for the 1,280 acres. The owners looked at him rather incredulously for a moment, but before they could speak he had counted out on the table $\$ 500,000$ in cash and drafts which he offered for a deed of the tract. I was appalled by the sight of the pile, but my father and the father of these gentlemen retired for consultation, and decided that if the property was worth $\$ 500,000$ it was worth $\$ 1,000,000$, and the offer was refused. Their heirs still own the land, and now it is valued at $\$ 20,000$. Where they could have got dollars we could scarcely get nickels. Thus you can see what seemingly fairy stories could be told of those days. They are almost incomprehensible to the present generation, but they were red hot facts," and a sigh of regret that the offer had not been accepted went round the circle.-Pittsburg Dispatch.

## The Forth Bridge.

This great bridge was formally opened on March 4. The construction was begun in the early part of 1883 The amount expended on the bridge works up to the present time is, in round numbers, $\$ 16,000,000$. The following table of the principal dimensions, taken from the volume on the Forth Bridge, by Mr. Philip Phil lips, one of the resident engineers at the works, will be found interesting:

Total length..
antilever arms projection (outer) ....... Upward of $11 / 2$ miles.
Depth of cantilevers over piers.
Depth at ends....
Distance apart of lower members at piers
Distance apart of lower m
Top members, distance apart at vertical columns.
Top members, distance apart at ends.
Struts, largest diameter.
Ties, greatest length.
Central girder, depth at center
Central girder, depth at ends.
Internal viaduct spans, various.
Total amount of steel in bridge.
South approach viaduct, total length.
South approach viaduct, average span
Wind pressure allowed for.... ................. 5 abor 168 i.
Depth of water in channels to be spanned.
Height of cantilever pier (masonry) a
Greatest air pressure in working the
caissons..............
Thickest steel plates..
Length of plates used in tubes aloue
Greatest depth of foundations.


The designers of the bridge were Sir John Fowle and Mr. Benjamin Baker, C.E., while the contractors or its construction were Messrs. Wm. Arroll \& Co

## The weight of Earth Worms.

Darwin estimated that worms, by swallowing earth for the sake of the vegetable watter it contains and form ing castings, bring to the surface as much as ten tons of earth per annum on an acre. Worms are great promoters of vegetation by boring, perforating, and loosen ng the soil, and rendering it pervious to rains and the fibers of plants, by drawing straws and stalks of leaves and twigs into it, and, most of all, by throwing up such nfinite numbers of lumps of earth called worm casts, which form a fine manure for grain and grass. The earth without worms would soon become cold, hardbound, void of fermentation, and consequently sterile this has occurred in many cases where the worms have been either accidentally or intentionally destroyed, and the fertility of the soil thus lost has only been restored when the worms had again collected and resumed their fertilizing work

Some one has said that boasting of what you will do is as unwise as to advertise your prosperity. If your plans are good ones, some one else will catch them up and be in the field in time to divide the advantage with you. If they are not good, you may be certain no one will point out the errors in them, so that you cannot possibly gain aught by your communicativeness. The men who listen well, and are not in haste to impart their own secrets, are the ones who generally get along in the world.

## Sorrespondence.

## Sun spots.

To the Editor of the Scientific American
I write to call your attention to a slight error in your last issue in regard to the sun spots
In the interval you mention of 68 days there were visible two groups of solar spots.
One of these, on October 15, had about eight small spots, and the second, on November 28, had two well defined spots.
These observations are in all probability correct, as they were observed by both Prof. Leavenworth and
myself.
F. W. Peirson.
Haverford College, Montgomery Co., Pa

## What a Canadian Engineer Thinks of the

Your issue of the 15 th inst. is more than especially interesting and instructive, containing, as it does, a description of the "San Diego Irrigation System," "The Rotation of Mercury," "The Manufacture and Use of Aluminum," "Poulet's Manual Instruction of the Mechanic," "The Caliber, Size, and Range of the Guns now being Cast in Rhode Island," "The Proposed Great Bridge between New York and Jersey City," "The New Dry Dock at Halifax, N. S.," "The City," "The New Dry Dock at Halifax, N. S.," "The
Mummy Cats of Beni Hassan," "The Pike's Peak Railwammy C
I have been a subscriber of your paper for the last 30 years or more, and have much satisfaction in recommending the Scientific American to the world at large, as probably the best, the most generally useful, of all the periodicals $I$ am acquainted with.
Being an architect and engineer, given to scientific research, it may not seem strange that $I$ should thus hold in estimation a journal containing so much of the technical information I am constantly in quest of ; but as a more tangible and practical proof of the general interest taken in your publication, by even unprofessional men, I will say that two of my friends, to whom I am "at home" on every Tuesday evening, A. G. Touranque, Esq., an ex-M.P. and an ex-mayor of Quebec, and F. D. Tims, Esq., assistant auditor of the Province, have, independently and unsolicited, expressed the opinion, frequently reiterated, that of all the papers they see-my Canadian friend at the "French Institute," my Hibernian friend at the rooms of the "Literary and Historical Society"-the rooms of the "Literary and Historical Society
Scientific American is the first they look for
Again let mesay that of all the papers received at the "Garnisus Club" in this city, and which are regularly put up at auction at the end of each week, the SCIENtific American is that which of its kind brings the nighest bid.
C. Baillairge,

Quebec, March 17, 1890.
City Engineer.

## Artificial Refrigeration.

In a recent paper read by Mr. M. C. Bannister befor the Liverpool Engineering Society, he said :
The best and most recent arrangement for refrigerat ing was that made by the Linde British Refrigeration Co., Limited, under the patents of Mr. Banfield. The cold brine was circulated through a shallow trough, in which revolved a number of shafts, each geared to gether. and driven by any mechanical means available. On the shafts were fixed a number of wrought iron disks, partly immersed in the brine, which cooled them down to the brine temperature as they revolved. Over thes disks a rapid circulation of air was passed by a fan, being cooled by contact with the plates; then it was led
into the chambers requiring refrigeration, from which into the chambers requiring refrigeration, from which
it was again drawn by the same fan; thus, all moisture and impurities were removed from the chambers and deposited in the brine, producing the most perfect antiseptic atmosphere yet invented for cold storing; while the maximum efficiency of the brine temperature was always available, the brine being periodically concentrated by suitable arrangements. This system had al the advantages of cold air machines, without any of the disadvantages, and could be worked at almost one sixth of the cost
Artificial ice making had now become a common commercial business, and was every day being more and more extended. It was some 25 years since it was first manufactured on any large scale; but there were now, in the aggregate some 100,000 tons made every day in various parts of the world, besides refrigerating and cooling plants equivalent to five times that amount; and the demand was still increasing by
bounds-in fact, the supply now could not meet the demand.

Cannot some one produce a better wagon wheel than at present exists? While American wheels are the best in the world, American roads are in the same or greater proportion the worst, and there is needed a
wheel which will have a strong set elastic tire, some thing that is more enduring than the rubber tire, which is in use to some extent, but not with every degree o satisfaction.

Professional Water Finding.
In the month of Decewber last we were requested by Messrs. Heerdegen \& Schnee to make an investigation of the claim of the former gentleman as to his ability by means of an instrument he had invented to discover subterranean water. This gentleman is an electrotechnical engineer, as it is termed in Germany, Bavarian by birth, but recently residing in Russia, and it was when there that he accidentally made the discovery of the principle of his apparatus. He brings with him a record of the most complete success attend-
ing his efforts in Russia, and the certificates to this effect, and the recommendations from houses of the highest standing in Moscow and elsewhere, leave no doubt as to a genuine belief there in his powers or those of his instrument.
We have endeavored to test the accuracy of the claim, but frow the outset we were confronted by two obstacles in the way of arriving at perfectly conclusive re sults. Throughout the test we have had the advantage of the co-operation of the Engineering News, Mr. A. M. Wellington or Mr. M. N. Baker being present at al of them.
The first difficulty in the way of making an exhaustive in vestigation lies in the fact that the instrument is not patented, and that, therefore, Mr. Heerdegen de clined to give us details of its construction; and al though we were allowed to see and to handle it, and even to try its operation ourselves, we were unable to follow the principles that govern its actions.

The other difficulty to be contended with was that Mr. Heerdegen's claim is to be able to locate under ground springs or streams under natural conditions, and it is evident that the only method of testing this conclusively would be to select a site where there was no knowledge or presupposition of subterranean water supply, and in case of a well being located, to sink
Mr. Heerdegen was, however, willing to waive thes natural conditions in their surictness, believing that the instrúment would enable him to locate running water equally well in iron pipes or in brick or in masonry conduits, and on this supposition the trials were car ried out.
The flrst tests were made on the line of the new aque duct in the neighborhood of Sing Sing, the point being selected by Mr. Charles N . Gowen, division en gineer, who was also present at the trial. The aque duct being here far below the surface, and no shafts being visible from the points selected, there is no possible clew to its location, especially to a stranger, and yet at two of the three points a large body of flowing water was located with wonderful exactitude as to the position, though inexact as to depth. It is only fair to state that the day was most unfavorable, being the very reverse of what Mr. Heerdegen stated as a prerequisite for accuracy. The second tests were upon the old aqueduct in New York, and they resulted in an accurate determination in one case, and slightly inaccurate in the other, and here again the difficulty of getting a satisfactory artificially arranged test was apparent, a we discovered on making inquiries of the city wate department that the rock surrounding the aqueduct at this doubtful point was full of springs, which may have had a stronger influence upon the operation
the artificially conveyed water in the conduit.
The foregoing tests were followed by an experimen ather than a test, which consisted in laying about 150 feet of $3 / 4$ inch steam hose on the second floor of the Raub building, at the corner of Nassau and Fulton Streets, Mr. Heerdegen being stationed upon the third hoor before the hose was uncoiled. This hose was passed in through various rooms, a stream of water eing sent through it, and Mr. Heerdegen succeeded airly well in tracing upon the floor above its genera direction and course.
The last test at which we were present was the most satisfactory and conclusive in every way, the element of uncertainty being eliminated as far as possible, the locality selected being outside the gate of the National Storage Company, near Communipaw, where the sup and entirely removed from all other pipes, drains, etc. and of course without any indication of its location. This pipe Mr. Heerdegen located with wonderful ac curacy and without hesitation, tracing it so nearly cor rectly that the engineer, Mr. Slater, who had laid it some years previously, and who was present, stated that it was substantially correct. This case was one in which, if Mr. Heerdegen had found it at first only by chance or by a shrewd guess, it would have been impossible for him to have repeated that guess successively three times.
During the occurrence of these tests, fortunately the opportunity was given to test Mr. Heerdegen practically as a well finder. Mr. Adolph G. Huffel, the brewer at 161st Street and Third A venue, New York, desired to have a well located at his brewery, where he had already drilled to the depth of 1,300 feet without finding water. As related by Mr. Huffel, "Mr. Heer degen went over the ground in the neighborhood of the brewery with his instrument, and discovered water
on the west side of our property, and expressed his
belief that water would be found within 30 or 40 feet of the surface in considerable quantities, and that the stream was 20 inches wide. Mr. Heerdegen traced the stream for about 1,000 yards, and pointed out in this distance four places where the same stream could be struck. Having selected the place most convenient to us, we commenced boring, and at a depth of 31 feet struck the stream. The water rose to within 10 feet of the surface, and a pump having been intro duced, the well yielded 50 gallons per minute for 120 hours without cessation.'

We have satsfied ourselves of the correctness of these facts and of the quantity of water given by the well.-Engineering and Mining Journal.

## The Musical Understanding of Animals.

A London Globe correspondent writes: A German paper states that experiments have recently been made in Lippe and Westphalia to ascertain whether military horses understand the bugle calls. The committee ap pointed have come to the conclusion that the animals have no clear comprehension of the meaning of these sounds, as a whole troop of riderless cavalry horses re mained quite unmoved by the different bugle calls. On the other hand, however, the editor of Thierfreund re lates the following story of his own personal experience of the sagacity of military horses :
In the year 1872, during a skirmish with the Sioux Indians, "the 3d Cavalry Regiment had formed an en campment in the valley of Niobrara, on the southern border of Dakota. At nightfall the horses were tether ed by a long line to the ground. Toward daybreak a violent storm of rain and hail burst over the valley. The terrified animals broke loose from their fastening and, in their fright, tore away up the steep sides of the valley into the territory of the enemy. Without horses, at the mercy of the enemy, we should be lost; yet it was impossible, in the half-darkness, to go after them into an unknown country, probably full of Indians The captain, as a last resource, ordered the stable cal to be sounded. In a few minutes every horse had re turned to the encampment, and we were saved." The Oesterreichischer Thierfreund states that both horse and dogs have been proved to have good ears for mu sic, particularly dogs, who have been known to whin piteously at certain passages, while at others they evince their delight and enjoyment by licking the per former's hand and begging him to repeat them. Ac cording to Aristotle, the flute is the favorite instrumen of the horse. The Sybarites taught their horses to dance to the music of flutes. This accomplishmen proved a serious drawback: for upon one occasion when at war, and the inhabitants of the luxurious city were about to charge their enemy, their opponents re mained stationary, each man producing a flute, and commencing to play upon it. The horses of the Sybarites at the accustomed sound immediately began to caper and dance in such a vigorous fashion tha their owners lost all control over them, and were obliged to show the flag of truce. Another story, which is stated to be well authenticated, but which seem almost too good to be true, appeared a short time ago in a German newspaper.
A gentleman who was a finished musician resided some years ago at Darmstadt. He kept a dog, which was the terror of all the singers and instrumentalists n the place, for it had the fatal habit of raising its face o heaven and howling whenever a false note was mitted. It never made a mistake, and well-known sing ers were said to tremble when they saw their unwel come judge, seated by his master's side, at concerts or at the opera, for "Max" was a regular first-nighter and a great friend of the theater director. He was never known to miss a new opera. "Max" was no respecter of persons, and when the singing was but a shade out, he would attract the attention of the whole audience to it with a terrific howl. One tenor went so far as to refuse to sing unless the dog was removed : but "Max" was so great a favorite with the Darmstadt public, and such a well-known frequenter, that the singer might as well have requested to have the director himself removed from the stalls, and he was obliged to give in with as good a grace as possible. The dog's master stated that he had trained him, when he was quite a puppy, by striking him hard when any one sang or played a wrong note; later on he tapped him gently; then he only had to look at him, and by the time he was three years old, the dog was as good a judge as his master of a false note.

## A Great Armor Plate Bending Machine

A few days since there was shipped from the Niles Tool Works, Hamilton, Ohio, a great armor plate bending machine for the United States Navy Yard at Mare Island, near San Francisco, Cal. The machine required eleven specially built and extra heavy flat cars, the two largest castings weighing respectively 66,400 and 66,200 pounds, and the gross weight of the train carrying the whole machine was 675,350 pounds. The entire distance to San Francisco, 3,400 miles, was to be run through without change, the machine to be taken thence forty miles by steamer to the yard. The taken thence forty miles by stea
freight was a little over $\$ 10,006$

MANUFACTURE OF PAPER ON THE CONTINENT.
When we refer to collections of journals of but forty or fifty years ago, we are much astonished to see before us sheets whose size rarely exceeds that of our present one cent papers. Moreover, the daily edition scarcely exceeded a few thousand copies. The great idea of the cheap press, it is true, had but just been put into practice by Emile de Girardin, and, although the paper machine invented by Louis Robert in 1799 had long permitted of dis pensing with hand-made paper, it was far from hav ing reached the capability of production that it now possesses. There was like wise a great revolution to be made in the selection of raw material. Rags, which until then had been which untlin had been exchusively employed in had become both of paper and too dear to allow their use to be continued as th sole supply for a demand that was increasing beyond all foreseen limits. It be came necessary to restrict the use of them for the choicest and costliest pa pers, and for others to find raw materials which while giving them the pro per strength and grain should permit of lowering their price to the excep tional figures at which w see them to-day. This is what constitutes the in dustry of rag substitutes and which utilizes, with proper treatment, alfa straw, and wood reduced to a pulp. All fibrous sub stances might be converted into paper, but the product obtained from them is usually too sinall to allow them to become the object of an industry, and it has become necessary, in practice, to make a choice of the substances just mentioned.
All these materials undergo successive preparations that we shall briefly describe, and then they pass into the paper machine, which is the principal agent of manufacture, and finally into acessorymachines, such as calenders, cutting machines, etc
The rags are first given into the hands of women, who cut them upon a knife placed in front of them upon a bench, and who separate from them such ob jects as hooks and eyes, buttons, and pieces of wool silk, and leather, and then class the product of their work, or sorting, between twenty baskets, which go to the storeroom.

After this the rags are cut into smaller fragments and put in quantities of 2,200 pounds into a cylindrical vessel having a rotary motion and containing lime water. Heating is effected through the introduction of steam under a pressure of from 2 to 4 atmospheres. The lime removes the greasy matters and the steaming prepares the rags for their ultimate conversion into a pulp. At the end of a day the material is ready to pass to the stuffengine. The present lime treatment replaces the rotting which was formerly done in vats, lasted from six to twenty days according to the nature of the rags, and was followed by a washing with water and a trituration in mortars by pestles covered with iron and actuated by a cam shaft

In the stuff-engine (which is an oblong trough) there revolves a cylinder armed with blades and situated opposite a stationary piece, which also is provided with blades. The passage of the
rags between the two apparatus reduces them to a pulp. The trough is separated in the direction of its long axis by a partition which permits of the circulation of the pulp. Opposite the cylinder there revolves, with a much slower motion, a drum covered with wire gauze, through which the dirty water escapes, while the meshes retain the pulp fibers. In addition, an arrangement at the bottom of the trough arrests all
the heavy objects, such as buttons, etc., that have not been attacked by the alkali.
These engines are situated in the second story of the building, so that their product can pass by gravity to the first story into vats of the same form, containing a solution of chloride of lime, and called bleachers. The paddles. others are frequently of metal.
evaporated in special furnaces (Porion's) which arres the bad odors. The salts obtained are dissolved, and made caustic by lime. The latter, in turn, as a re siduum of the operation, gives an excellent fertilizer The revivification permits of recovering 80 per cent of he soda employed.
The woods that are used in the manufacture of paper are treated in two different ways, one mechanical and the other chemical. In the first, soft woods are espe the other chemical. In the first, soft woods are espe cially employed, such as the aspen, poplar, etc., and in the second, the fir, and particularly the silver fir which furnishes a very pure cellulose.
The mechanical pulp is obtained by abrading, on a horizontal grindstone billets of wood 12 inches in length arranged in cell and held by clamps agin the perimeter of the A continuous the stone A continuous current of
water carries along the pulp formed, and which i further refined by anothe mill before it passes to th lixiviators. Norway which, as well known, is widely covered with for ests, furnishes Europe with a very large quantity of mechanical wood pulp.
The chemical pulp, which was formerly made by treating wood with caustic soda, is now almost uni versally obtained by the action of bisulphites, and particularly of bisulphit of lime. This proces which appears proces Alfa or esparte, which is especially employed in Eng- been first adapted to industrial practice by Dr. Mit land, is carefully sorted and submitted to the action of soda instead of lime, at a pressure of four atmospheres. The operations of cutting and bleaching are he same as for rags.
The manufacture of straw pulp is much more gen eral in France than that of alfa. All kinds of straw re used, and, as one gives just as good results as an ther, they are worked without distinction. After they have been cut by the chaff cutter, and then freed, by winnowing, of their spikes, knots, dust, etc., they are introduced into a lixiviating cylinder (either stationary or rotary) under a steam pressure of frow 4 to 6 atmo spheres. A six hours' treatment with steam suffices for a charge of 2,200 pounds. At the end of this time, the pulp is put into double-bottomed vats, where it drains and from whence the lye is extracted, to be converted again into caustic soda. If the pulp ob
tained is very good, it is washed with water in the
been first adapted to industrial practice by Dr. Mit
scherlich, has received various improvements in Swe scherlich, has received various improvements in Swe-
den, Austria, and France. It gives more economical results than soda, because of the much lower price of the bisulphite of lime.
The wood, which is in general that of the silver fir is washed and decorticated, and then cut by a circular saw into billets 3 feet in length, and finally split by machine. In this state through the aid of an inclined box it is presented to a mechanical cutter (Fig 1), com box, it is presented to a mechanical cutter (Fig. 1), com steel blades and revolving with great rapidity. This nachine furnishes 35 cubic feet of wood shavings in the pace of 6 minutes, and these shavings are thrown into baskets, whence they are afterward taken and spread upon wide tables provided with a grating through which the dust passes. The remains of knots or bark that would not be well adapted for treatment with alkali are carefully picked out by women. The shay The shay


Fig. 2.-APPARATUS FOR TREATING CELLULOSE WITH BISULPHITE OF LIME. ings are then taken to the first story in baskets and put into the lixiviating ap paratus. As the latter pre sents a few peculiarities because of the extremely corrosive action of the bisulphite of lime, we shall first speak of the manufac ture of the bisulphite. This is obtained by the reaction of sulphurous acid produced either by the roast ing of pyrites or by the burning of sulphur upon a column of lime stones. The gas traverses this column from bottom to top, and the reaction is facilitated by a showering with water in the opposite direction, and so regulated as to give a lixivium of a proper density The bisulphite formed is collected at the base of the column. It is a colorless liquid, of an odor as suffocating as that of sulphurous acid, and attacks all the common metals except lead. So the iron plate lixiviating apparatus have to be provided with a lining of cement upon
same vats, and is then bleached inclarge basins under the action of chloride of lime. There is nothing further to do but to drain it in order to render it ready to be worked. The product in bleached pulp is about 40 per cent.
This manufacture can be remunerative only on condition that the soda is recovered from the lye. To this effect, the lye, as well as the first washing water, is
which are laid several sheets of lead (Fig. 2). Besides, they are inclosed in masonry of refractory bricks, which are themselves covered with lead, and all the openings for the introduction or removal of the material are lined with the same metal.
These apparatus, which are of a very large capacity worm made of an alloy of lead and antimony permiti
of the introduction of steam into the apparatus in order to raise the bisulphite to a temperature of $130^{\circ}$. but, as the steam might blacken certain parts of the pulp, it is introduced either through a double bottom or through lead worms with which the sides of the apparatus are provided.
The reagent removes the gummy and resinous substances, and these are retained in a residuum of sulphate of lime, while the cellulose remains in a practically pure state. In order to free it from the last traces of acid and resinous substances, it is washed with water, without any trouble being taken to collect the residua, which have no value. But the cellulose, which has preserved the appearance of wood, must be reduced to a finer pulp in order that it may be pumped to the purifying apparatus. So, on coming from the lixiviating apparatus it passes into large rats, where it is submitted to the action of an agitator that keeps it constantly in motion. From thence it is forced to the purifiers, which comprise the collectors (long wooden conduits, in which the heavy matters are deposited, and the sifters, which consist of boxes with a movable bottom provided with apertures that let the good pulp pass, and retain all else.
The pulp is finally drained in conical rotary sieves, and can then be directly employed for many papers, such as those on which journals are printed, colored papers, etc.
However, it has to be bleached by the mixtures designed for the finer papers. To this effect, there is now used a very ingenious process of electro-chemical bleaching, devised by Mr. E. Hermite. It consists in the decomposition of calcium or magnesium by the passage of an electric current. This forms a liquid possessing a most intense decolorizing power. In the presence of the vegetable fiber, the primitive salt is regenerated in measure as the bleaching proceeds, so that at the end of the operation the same bath can be used again. The sole loss of chloride is what the fiber has taken from the bath. The entire expense, then, is reduced to that occasioned by the production of the motive power necessary to actuate the dynamos, and the keeping of them in repair.
Finally, we may consider the waste of paper mills, or that of the industries that employ paper as a substitute for rags. Old papers are always sorted before being used. Those containing printed matter are first treated with soda before being refined, and then bleached with chlorine. They are afterward taken to granite millstones joined in pairs and running vertically over a third and horizontal stone inclosed in a cast iron vat, into which water is run while the waste is being thrown in. The same operation is applicable to the Norwegian mechanical pulp, in order to render it finer and more homogeneous.
The various pulps that we have just examined, being obtained either in the same mill or purchased outside, have to be mixed according to the qualities that it is desired to obtain. Delicate fibers, like those of cotton rags, yield a thin pulp and flexible and soft paper. Coarse and strong fibers, like those of hemp and flax, furnish a thick pulp and a transparent and smooth paper. Mechanical wood pulp, the fibers of which are very short, adds opacity and body, but quickly becomes yellow. Cellulose, which forms chemical wood pulp, furnishes an excellent pa per, silky and soft to the touch and well adapted for printing. Straw pulp has shorter fibers than those of the preceding, but gives transparency and uniformity. Finally, alfa comes neares to rags, and constitutes the sub stitute therefor par excellence.
The mixture is made in beat ing engines, which are established in series of three. It is in these apparatus that the paper is sized in order to ren der it impermeable to ink. The sizing is done with a resinous soap, prepared by melting resin with carbonate of soda. The addition of a little alum to the vat precipitates a resinous compound of alumina, which agglutinates the fibers.

A weighting composed of kaolin, plaster, sulphate of baryta, etc., is used for common papers, of which it corrects the transparency and to which it gives whiteness. From 5 to 20 per cent of fecula is generally added to it, in order to fix it better to the fibers. Finally, the coloring, when pulps formed of colored rags are not used, which is most generally the case, is done by pouring the colors into the vat through a very fine sieve or


THE COLES DOUBLE-FEED SEWING MACHINE.

## AN IMPROVED SEWING MACHINE.

The accompanying illustration represents a sewing machine having an improved feeding mechanism, patented by Mr. David H. Coles, of New York City, by which the material is clamped both top and bot tom, and fed through the machine without any displacement whatever, no matter how the material may vary in thickness, or whether it be cut straight or curved.
Figure 1 is a perspective view of the machine, partly broken away to show the working parts. On the main shaft is a cam, shown in section in Figure 2, which engages with the upper end of an oscillating lever turning on an adjustable pivot, and connected by a link to an arm mounted on one end of a rocking shaft, the other end of which has an arm connected to the lower feed carrier. This carrier slides in bearings on the under side of the cloth plate through a slotin which the feed dog projects and acts on the under side of the fabric to be fed, the lower feed having only a horizontal motion. A rock shaft which serves to actuate the upper feed also receives its motion from the cam mounted on the main shaft, shown in Figure 2, whereby the oscillation of the upper feed dog necessarily corresponds with that of the lower one, the motion being preferably transmitted through the link which also moves the lower feed. The feeding surfaces of the feed dogs may be either roughened or left smooth, according to the nature of the work, which is always held either between the feed surfaces or between the presser foot and the cloth plate, each releasing the work as the other takes hold, whereby no unequal stretching takes place, and both surfaces of the work are fed evenly. To adjust the throw of the two feeds or regulate the length of the stitch, a sleeve is carried by the adjustable pivot about which the lever engaged by the main shaft oscillates, this sleeve being pivoted in a carriage moving in a slot in the upright portion of the arm of the machine, where it may be adjusted by a set screw, as shown in Figures 1 and 2. The ac tion of this double feed on the material being operated upon, as compared with that of the ordinary sewing machine, is illustrated in Figures 3 and 4, the former figure showing the material passed through smoothly, because clamped by both a top and bottom feed, while the latter exhibits the wrinkles in some cases almost unavoidably made by the material being pushed forward by a single feed, either under or top, against the fixed pres sure on the other side. It is claimed that with this machine no basting is required, ther being no displacement of the material as it is being sewed, while the feed automatically ad justs itself to any thickness of fabric, always lifting to just the height required without any lost motion, the object of the machine being to cover a range of work which it has been impos sible to do heretofore in a satis factory manner on any machine For quilting, also, the machine is said to work as perfectly as a regular roller feed quilting ma chine, puffing the work in the most elegant manner, and work ing with the greatest speed.
For further information rela tive to this machine, addres the Manhattan Quilting and Manufacturing Co., room 200 No. 45 Broadway, New York City.

British Refrigerating Ships.
Our food supply has been largely increased by the application of apparatus for me chanical refrigeration to ships Our frozen meat trade with New Zealand is of recent develop ment, and it has already reach ed enormous proportions. At present twenty-seven steamer and ten sailing vessels, all fitted with mechanical refrigeration
ventilating passages therein, Fig. 2 showing a longiudinal section of such an armature core, while Fig. 3 is perspective view of such an armature when wound The invention also provides for a slightly different construction of the armature ring by using two series of plates to be placed together alternately, the aligning edges of their radial slots forming continuoue radial apertures and spaced longitudinal rectangular passages which will admit a current of cool air to the interior of the core, the notches in the periphery of each plate affording longitudinal grooves on the outer surface of the core for the winding of the armature.
This invention has been patented by Mr. John C Wray (in care of Monarch Distilling Co.), Peoria Ill.
wachinery are engaged in this trade. The agregat machinery, are engaged in this trade. The aggregat onnage of these twenty-seven steamers is 12,000 tons, the an average tonnage of about 4,500 tons, whing ships is 10,000 tons, or an average of 1,000 ons each. It will thus be seen that thirty-seven ves sels are engaged in this trade, of $13 \%, 000$ tons tota carrying capacity. The total frozen meat cargo which these vessels can carry in a single year amounts to the enormous number of $2,250,000$ carcasses, which cer tainly gives some idea of the great importance of this trade. It is estimated that not more than $1,500,000$ arcas will be available for the trade this year so that the carrying capacity is more than sufficient for the present volume of trade.-Steamship.

## LAUNCH OF THE UNITED STATES STEEL CRUISER

 NEWARK.Just after noon on the 19th inst., while snow was falling fast, the new 4,000 ton U. S. steel cruiser Newark was launched from the shipyards of Messrs. William Cramp \& Sons, Philadelphia, as shown in our first page illustration. There was present a distinguished company, Rear-Admiral Jouett representing the Secretary of the Navy, and from the Navy Department were four of the bureau chiefs, Commodore Farquhar, of the Bureau of Yards and Docks, Theodore D. Wilson, of the Bureau of Construction and Repair, George W. Melville, of the Bureau of Steam Engineering, and John M. Browne, of the Bureau of Medicine and Surgery. It is estimated that notwithstanding the uncomfortable weather there were six thousand people present, and at the collation given following the launch there were fully five hundred in attendance, including a large number of officials and prominent citizens from all sections of the country.
In addition to platforms built beyond the sides of the vessel, a special platform was erected around the bows for the christening party and the principal guests, and the beak of the great metal ram projected right up among those gathered at this point. At 12:30P. M. the last supports which had held the ship in place were

The Newark has a double bottom for 127 feet, cover ing the space occupied by the engines and boilers, the depth between the inner and outer skin plating being about 39 inches, and this space being divided into 12 watertight compartments by means of solid floors and a vertical keel. The engine and boiler space is divided into 17 watertight compartments, while the space between the engine and berth decks is divid ed into 72 watertight compartments. On the berth deck are 7 watertight compartments, and all the open ings from this deck to the engine and boiler rooms are protected by coffer-dams, while the scuttles, hatches, and storerooms are watertight. Below the gun deck, when all the watertight doors are closed, there are 147 distinct compartments, and there are 85 such compart ments when the doors are all open.
The protective deck, for 168 feet of its length, rises to fifteen inches above the load water line, while forward it slopes to $4 \frac{1}{2}$ feet below the water line, to strengthen the stem, and abaft it slopes to 3 feet below the water line. The horizontal portion of this deck is about 2 inches thick, which is increased to $31 / 2$ inches over the steering gear, while the sides are about 3 inches thick, the angle of inclination being designed to prevent a shutters and scuttles of the same blow upon it. Armo
long, designed for a steam pressure of 160 pounds to the square inch, and with a grate surface of 540 square eet. Sail is to be used only as an auxiliary for cruis ing purposes, but a spread of 11,932 feet of canvas is provided for.
The incandescent system of electric lighting is to be adopted throughout the vessel, which will also be sup plied with electric search lights. The ventilation will be effected by the exhaustsystem, which is said to have been found very efficient in the navy.
The Newark is the final one of five government war ships built by William Cramp \& Sons, the other fou having been the Vesuvius, Yorktown, Baltimore, and hiladelphia. In size and general dimensions the Newark greatly resembles the Baltimore, although her lines are quite different. It will probably be autumn before this last vessel will be furnished with her ma chinery and fittings and be ready for trial. She is in tended for use as a flagship, and the space under her poop will be made into quarters for the admiral and captain. She will have a crew of about 300 men.

A New Plan for Rapid Transit in New York.
A plan for the solution of the rapid transit problem in this city has been formulated, and presents a very striking and original aspect. It originated with the

knocked out, and as she started off the ways she was christened by Miss Boutelle, daughter of the chairman of the Naval Committee of the House of Representatives. The launch was in every way successful, the headway of the vessel being checked in about 200 yards, when she was slowly towed back to the dock.
Especial interest attaches to the Newark from the fact that she is essentially an American ship in design, material, and construction, whereas several of the othe new cruisers have been largely built after plans fur nished by foreign engineers, and are, to some extent copies of existing vessels in the English navy, although with material modifications. The Newark is a twin screw unarmored vessel, having a poop and forecastle deck, with an open gun deck between. She is built of mild steel throughout, and has a steel deck extend ing her whole length, below which are the engines, boilers, magazines, shell room, torpedo spaces, and steering gear. The engines and boilers are further protected by coal bunkers, which serve as extra armor as well as fuel stores. The engines are designed, with natural draught, to afford 6,000 horse power, to be increased with forced draught to 8,500 horse power and to give a maximum speed calculated at 18 knotsper hour. The following are the principal dimensions of vessel :

are fitted at all hatchways and openings, and these are also inclined to deflect projectiles. The coal armor belt is about nine feet thick amidship, and seven feet orward and aft
The main battery of the Newark consists of ten sixinch breech-loading rifles, each using a 100 pound shel with a powder charge of fifty pounds, the projectile being designed to pierce thirteen inches of iron at its muzzle velocity. The guns are mounted on central pivot carriages, with circular shields fitted to each to protest the gunners from the fire of machine gums. The two forward guns, one on each side, are trained from 70 degrees abaft the beam to 95 degrees for ward, giving a cross fire of five degrees at 111 feet forward of the stem. The two after guns have nearly the same range of fire, and all of the battery on one side can be con centrated on an object not more than thirty feet away. The secondary battery consists of four sis-pounders, four Hotchkiss revolving cannon, and two short Gat lings, while there will be other Gatlings in the fore and aft tops. The vessel will also have six torpedolaunching tubes worked from the berth deck. The ram-shaped bow of the Newark, as compared with that of the Philadelphia, is shown in one of the views on the first page. It is thoroughly stiffened and strengthened by bulkheads and breasthooks for ramming purposes.
The boilers and machinery of the Newark are said to be all ready to be put in, the power to be furnished by two triple expansion engines with cylinders of 34 , 48, and 76 inches diameter and 40 inch stroke. There are four boilers, each $131 / 2$ feet in diameter and $191 / 2$ feet
late Mr. D. C. Lindsey, C.E. It contemplates the erection of a structure which will carry a four-track railroad. This structure is to be of masonry, and to be about 60 feet high. It is to be carried through the center of blocks, and the streets are to be bridged by steel bridges. By making the substructure heavy enough it will be available for stores and tenements. The route is to extend north just through Tarrytown. It is to form a loop in the southern part of the city from Leonard Street south. The only public property touched is a small corner of Battery Park. To carry out the plan, "The People's Rapid Transit Company" has been organized. The principal features of merit of the plan are the capacity for high speed, the avoiding of any but the most limited trespass upon streets or private grounds, and the fact that it is an overground way. It is estimated that the acquisition of real estate will cost over $\$ 70,000,000$. The entire cost is estimated at nearly $\$ 90,000,000$.

## The Ascent of Mount Kilima Njaro.

A German expedition, under the direction of Dr . Meyer, has succeeded in reaching the top of this marvelous peak of Central Africa, which stands only three degrees south of the equator. The expedition was working for sixteen days at a height of over 13,000 feet, making four ascents to the Kibo summit and three to the Mawenzi summit. Here, surrounded with perpetual ice, they found the crater of the great Kibo mountain, having a diameter of about 6,500 feet and a depth of about 650 feet. The aneroid gave the height of the highest peak as 19,690 feet.
recently patented inventions.

## Engineering.

Boiler Tube Scraper. - John B. Christoffel, New York City. This scraper consists of a edges, adapted to be easily and quickly contracted or expended to fit various sized tubes, and readily cut the hard crust usually formed in water and steam tubes,
the invention heing an improvement on a former pathe invention being an improvement on
Boiler Setting.-Daniel King, Finksburg, Md. This invention provides for an arched combustion chamber with a bridge wall in the rear of
which is a chamber, there being a boiler space above the arch and chamber, and another chamber extending from the front end of the boiler space down in front of and under the combustion chamber, for effecting thorough combustion of the fuel gases mixed with air and steam when necessary in a highly heated reverb
atory furnace before contact with the boiler surface.

Rallway Appliances.
Car Coupling. - George F. Harlan, Leeds, Md. In this coupling the coupling bar has an arrowhead at one end and at its opposite end an open-
ing for the securing pin, while the drawhead has guide openings for the coupling pin, there being spring plates on the opposite sides of the openings to direct
the arrowhead into engagement with the coupling pin held in the guides.

## Mechanical.

Bit Chuck. - John W. Miller, Mount Sterling, Ky. This chuck has a longitudinally slotted body, jaws with tapering outer faces pivoted in the slot and a spring normally holding the jaws apart, while a
spring surrounds the body and jaws and a sleeve fits spring surrounds the body and jaws and a sleeve fits
over them, whereby the chuck is capable of instantly over them, whereby the chuck is capable of instantly
and securely fastening and adjusting itself to any sized

Nut Lock. - Aaron C. Vaughan, Shane's Crossing, Ohio. This lock consists of a plate adapted to be applied to the bolt outside the nut, the
plate having a bolt hole with oppositely threaded sections between which the metal is cut away, and having upturned wings lying tangential to the threaded parts
of the bolt hole, and also threaded on their sides, the of the bolt hole, and also threaded on their sides, the
wings serving to pinch the bolt and lock the nut thereon wings serving to
by spring action.
Punching Machine. - George F. Breuer, Humeston, Iowa. This is an attachment for
anvils comprising a pivoted standard with an aperture to receive a punch, a clamping device for securing the standard to the anvil, and a bed plate adapted to fit on or cold iron, and arranged to be adjusted so that the parts will not interfere with the use of the anvil for ordinary purposes.

## Miscellaneous.

Potato Peeler. - George B. Haines, New York City. This device consists of a segmental curved plate having its upward bent end provided with on its under side at the openings, one of the knives being on the lower edge of the bent-up end of the
plate, the tool being specially adapted for rapidly plate, the tool being specially adapted for rapidly
and conveniently peeling apples, potatoes, and like egetables and fruits.
Shaving and Dressing Stand. Mary E. Greene, New York City. This invention prothe reception of the shaving utensils, with legs pivoted on the standards and pivotally connected with a table
hinged thereon, the stand being easily folded up when hinged thereon, the stand being easily folded up when not in use and afford
the shaving utensils.

Curtain Fixture. - Frederick Spitz, New York City. This invention provides for a curtain pole ring having an inward projecting angled bena, and a friction roller through which one arm of the bend passes, whereby the curtain will be held close to the
pole, and at the same time permitting an easy sliding of the curtain whenever desired.
Sewing Machine Guide. - Alice La Guayra Mayo, New York City. This is a standard for a longitudinal opening held to slide upon one face of the standard, while arms projecting downward and outward at an angle to the ends of the bar are provided with upwardly curved outer extremities, the device being adapted for use either as a right or lef
without being detached from the machine.
Flash Torch. - William L. Heiskell, Indianapolis, Ind., and Francis E. Drake, Columbus, Ohio. This is a device adapted for use in connection with theatricals, etc., having detachably united casing
sections, and a valved air bulb connected with a powder magazine upon which is supported a lamp, the powder conduit from the magazine to the lamp being straight and direct, insuring effective operation at all times.
Easel. - George L. Hann, Beverly, and arrangement of parts for an easel which may be folded compactly when not in use, and may be secured by a single latch or fastening
Folding Door. - Albert Ney and Joseph Baumgartner, Dubuque, Iowa. This invention relates to doors supported on hangers attached to the
inner edge of the door and to the door frame, permitting the door to be moved without contact with either the floor or the cap of the frame, there being combined
with the door and its frame hangers attached to pivots fixed to the door and to a bracket upon the door frame.
Heating Stove. - Salathiel Fancher, Kansas City, Mo. This is designed to be
simple and non-explosive oil-burning stove, easy to
manage and adapted for quick and thorough regulation
of heat, the supply of oil being readily lessened or cut of heat, the supply of oil being readily lessened or cut off from the vapor generator, while there will
liability to sooty clogging in working the stove.
Skirt Protector. - Malcolm H. Smith, New York City. A water proof outer skirt 18 made with a continuous tape around its upper edge, there being an extension below the tape on which is a
series of fabric grasping or clamping clips to grasp the series of fabric grasping or clamping clips to grasp the
free portion of the tape, or the fabric of the underskirt, thus inclose the bottom of the skirt
Bolt. - David A ustermuhl, Jr. Cramer's Hill, N. J. This is an automatic locking device for sliding door bolts, embodied in the form of to pass through and engage with a bolt keeper, or the catch may be made to engage any other fixed projection instead of the keeper.
Furniture Drawer. - Elijah F. Waller, Hanson, Ky. This invention affords an improvement in tilting drawers, the frame receiving the
drawer having a cross bar at its rear on which the drawer rests when closed, and the drawer having depending legs at the front pivotally supported by the
frame, the drawer opening in such a way that articles frame, the drawer opening in such a way that artic
cannot be canght to interfere with its movement.

Water Closet.-Charles R. Schmidt, Baltimore, Md. This closet has an all-porcelain hopper and trap, with flushing rim and a special passage to the bottom of the hopper and a bent discharge outlet, form-
ing a siphon above the level of the flor, whereby both ing a siphon above the level of the floor, whereby both
suction and force are used for emptying the hopper, suction and force are used for emptying the hopper,
which normally stands filled with water taken from which normally stands filled with water taken from
a tank four or five feet above the level of the closet.
Road Cart. - Patrick W. Fergus, Mineola, N. Y. In this cart the body springs have
a rocking bearing on the axle, combined with longia rocking bearing on the axle, combined with longi-
tudinally ranging keepers on the shaft and pins on the tudinally ranging keepers on the shaft and pins on the
body entering the keepere, and having backward and body entering the keepere, and having backward and
forward play therein, for the purpose of redacing horse motion " to a minimum.
Wagon Body. - Benjamin F. Short, Buena Vista, Ga. This body is made in two parts, so that the upper one may be easily lifted from the lower, each part having its ends provided with horizontally
swinging end boards at each end, whereby the wagon may be easily adapted to carry small truck or heavier articles.
Barrel Truck and Jack.-James H. Stansbury, Lawrence, and Isaac U. Hyatt, Jamaica,
N. Y. This is a simple and durable truck for barrels containing oils or other merchandise to be drawn off or retailed from the original packages, by using which the labor of handling and placing the barrel in convenuent
position may be materially lessened, allowing one man position may be materially lessened, allowing one man
to easily do what would ordinarily require the work of o men.
Burglar Alarm.-Julius Vogel, New York City. This is an alarm for windows or doors in which a detonating cap is exploded when the door shell being fastened in an inclined position to the door or window casing, and the apparatus tripped when the door is opened.
Tobacco Pipe.-Charles D. Weldon, sections, ashington. The stem of this pipe is made in cleaner provided with a ring fitted to the joint betwee the sections of the stem, whereby the cleaner will be
always at hand and in no way disfigures the appearalways at hand and in no way disfigures the appear-
ance of the pipe.
Paper Bottle.-Hubbard F. Bannard, Nashville, Tenn. This is a conical bottle having its
bottom formed with an annular groove, and having a bottom formed with an annular groove, and having a
tubular nozzle, making a strong, cheap, and durable bottle, and one not easily tipped over, especially adapted to hold ink and mucilage.
Water Trough for Cattle Cars. -Ferdinand E. Canda, New York City. According to this invention, a series of troughs or buckets are ar-
ranged on ether side of the car, the buckets being hinged to a supporting rod having inwardly extending arms to engage them, whereby the buckets may be turned up singly or collectively by means of a crank
Butter Crate.-William H. Ferguson, Seattle, Washington. This is a cylindrical crate with closed sides and bottom, and a top adapted when placed in position to effectually exclude air from the interior, the inner surface of the crate body having an annular recess into which the top closely fits, while the inner surface of the crate also has longit
tending from the top to the bottom.
Bagasse Drier. - Manuel Espinosa, Matanzas, Cuba. A casıng within a housing is prothrough the casing in connection with barriers or deflectors for imparting a tortuous or serpentine draught, the heat being delivered above and below an advancing stratum of bagasse, provision for agitating
which is made and for carrying off the vapor produced. Oil Can.-Jean M. N. Jay, New York City. This can is so constructed that the spout may be
manipulated to permit the liquid to flow or to cut off the supply, means being also provided whereby any extraneous matter in the vessel with the oil will b
tually prevented from passing out with the oil.
Blind Stile Boring Machine.- Wil liam C. and John A. Aycock, Griffin, Ga. In this machine a mounted sliding frame carries the bits, markers pins held on the frame are adapted to actuate the pins held on the frame are adapted to actuate the
levers on the up and down motion of the frame, with other novel features, the machine rapidly boring the aperture and automatically marking the mortises.
YARN NIPPER FOR SPINNING MAdevice for use in the manufacture of yarns or cordage,
the nipper having several novel features designed, in connection with a suitable fiber or sliver feeder and twisting device, to produce a com pactly and smoothly
twisted yarn or cord with economy of time and labor.
anchor Alarm and Tide Tell-Tale -James W. Jones, New York City. This is an alarm onnected with a rope or chain arranged to be held to he bottom in case the vessel is anchored, or to
wharf in case the vessel is moored, to give an alarm should the anchor drag or the moorings give way. or to sound an alarm at the moment of the chauge of tide.
Apparatus for Ice Manufacture. James W. Brook, Lynchburg, Va. This is a fram may be supported ice cores or posts formed of section or blocks of ice one on the other, with troughs to dis-
charge water thereon, whereby ice may be frozen in charge water thereon, whereby ice may be frozen in
position in cold weather, and then inclosed as desired in warm intervals, to prevent thawing, thus affording means of obtain
summer season.
Mould for Ice Blocks.-This is an other patented invention of the above inventor for a to form the ice posts or cores to which water is applied as above described, the main portion of the mould being preferably formed of thin metal into a tapered
expans:ble body piece readily freed from the ice block expanstble body piece readily freed from the ice block Motor Sled.-Calvin Jackson, Jack onwald, Pa. This is a sled with runners and a bicycle rame, in connection with a pair of lazy tongs having pusher legs to be operated by the rider's feet, its two
runners assuming the place of tandem wheels, a steerrunners assuming the place of tandem wheels, a steer-
ing device being connected to the front runner, and it bing designed for use by both sexes.
Gauging Rod. - Arthur M. Hill, St. Stephen, New Brunswick, Canada. This is a graduated straight edge and a slightly curved edge at nearly right angles to the straight edge, to better measure the contents of kegs and casks by allowing for the slo

Ant Trap. - Joseph L. Stillman Fresno, Cal. This is a device to be attached to the legs or base of the table, refrigerator, or otber article to be protected, and has at its bottom a socket for a caster or
roller, above which is a circular water trough, the device roller, above which is a circular water trough, the device
being applicable to receptacles which have either legs being applicable
or flat bctoms.

SCIENTIFIC AMERICAN

## buIldina EDITION

MARCH NUMBER.-(No. 53.

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tive view.
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floor plans.
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15. A model farm house.
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Əusiness and æersonal.
The charge for Insertion under thes head is One Dollar a line jor each insertion: about eight words to a line as early as Thursday morning to appear innext issue.

To Manufacturers Electrical Machinery, etc.-Please nd, New Zealand. ratents and special tools for best drill chuck in world or sale dirt cheap. Address B. F. Chappell, So. Windor sale dirt
ham, Conn.
Wanted
Wanted Immediately-Two Fox lathe hands at Faran's Brass Works, 23 Center
Moulders-A thoroughly competent brass moulde wan ed. One who is accustomed to small work and un wan ed. One who is accustomed to small work and un-
derstands mixing metals. Address L. M. P., care of Sci-Wanted-Engineer American, New
Wanted-Engineer or practical man to take charge of a battery of boilers. Must be familiar with steam mak charge of the plant. ingenious, and able to introduce economy or carry out any suggestions that may be made.
Address, stating age, qualifications, and salary expected, Address, stating age, qualifications, and sala
J. W. Van Dyke, Solar Refining Co., Lima, O
The locomotive "Onward," illustrated in Scientific American of March 8, is drawing the Philadelphia ex
press on the Central R:R. of N.J., daily. For futl infor ation respecting this locomotive address C. C . ton, president, at Fifth Avenue Hotel, New York.
Wanted-Proposals from manufacturers to build on royalty the Coles double feed sewing machine. See illus Chain Factory for Sale.-Owing to the death of the proprietor, the Star Chain Works at Trenton, New Jerseg,
are offered at private sale. This is an old established oncern now in full operation, it has good trade connec tions, and is located on a branch of the Philadelphia \&
Reading R.R., so that there are no cartage expense With a moderate outlay the capacity of the work can be
doubled. Inquire of H. L. Shippy, No. 117 Liberty St.. doubled.
New York.
The best book for electricians and beginners in elec tricity is "Experimental Science," by Geo. M. Hopkins.
By mail, $\$ 4$; Munn \& Co., publishers, 361 Broadway, N. Y. Wanted-Expert die cutter for drop forgings. Apply
with references, to M. Butterfeld, Lee's summit, Mo. Wanted-A thoroughly competent designer of wood-
working machinery by a well established house. To the working machinery by a well established house. To the
right party a frst-class opening. Address P. O. box 1001 , right party a first-class
New York, Best Ice and Refrigerating Machines made by David hies in satisfactory team pumps, vacuum pumps, vacuum apparatus. alr pumps, acid blowers, filter press pumps, etc.
Wanted-Mechanical draughtsman. A practical man with a mechanical education, capable of directing the
construction and erection of machinery. Address, stating age, qualiffcations, and salary expected. J. W. Van ing age, qualifccations, and salary
Dyke, Solar Reaning Co., Lima, 0 .
Presses \& Dies. Ferracute Mach. Co., Bridgeton, N.J The Holly Manufacturıng Co., of Lockport, N. Y.,
will send their pamphlet, describing water works ma inery, and iontamp Tuerk water motors at 12 Cortlandt St., New York. Screw machines, milling machines, and drill presses.
The Garvin Mach. Co., Laight and Canal Sts., New York. Packer Ratchet Drills are drop forged from Norway For lowo prices on Iron Pipe, Valves, Gates, Fittings, \& W . s. Carr Co., 138 and 140 Centre St., New York. Wanted-A first-class foreman for boiler shop. Must en. Address, stating age, qualiffcations, and salary e pected, J. W. Van Dyke, Solar Refning Co., Lima, o.
Steam Hammers, Improved HydraulicJacks, and Tube Steam Hammers, Mmproved Friction Clutch Pulleys. The D. Frisbie Co., N.Y. city "How to Keep Boilers Clean." Send your address For best hoisting engine. J. S. Mundy, Newark, N. J. For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J,
S. $\&$ G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y. Split Pulleys at low prices, and of same strength and appearance as whole Pulleys. Yocom \& Son's Shaftin
Works. Drinker St., Philadelphia, Pa. Works. Drinker St., Philadelphia. Pa.
Wanted-Canvassers in every county in United States Only those who mean business need apply. Send stamp
for particulars to patentee. J.N. Reimers, lock box 6 .

## NEW BOOKS AND PUBLICATIONS

Payne's Business Educator. By F.
M. Payne. New York: Excelsior Pub lishing House. Pp. 596. Price $\$ 2$. This work comprises an epitome of Federal and State way of commercial laws, forms, and requirements ar contained within its covers. The ground covered by it is varied, including commercial letter writing, commer cial forms and tables, parliamentary law, lessons it typewriting and penmanship, and finally laws, togethe with forms for practical use, the latter of almost every
conceivable form that may arise in everyday life. A dictionary of eynonyms is a useful addition. placed at the end of the volume, and fills nearly fifty pages. The work is one of very general usefulness
and will be acceptable to a very large clientage of readers.
The Legal Advisfr. By F. M. Payne New York: Excelsior Publishing
House. Pp. 317 . Price $\$ 1.50$. In this work we have included a portion of the one just noticed. The subjects are alphabetically arranged running from "Acknowledgment" to "Warranty," Water Course, and $\begin{aligned} & \text { Some of the specialls } \\ & \text { important topics treated are assignments, mortgages, }\end{aligned}$ deeds, interest, landlord and tenant, promiseory notes trademarks, copyrights, etc., etc. For those not want ing the larger work, this supplies the more generally useful portion.

M Micstaturies
HINTS TO CORRESPONDENTS Names and Address must accompany all letters,
Nor no antention will be paid therote.
(2019) J. L. D. asks: How can w make a small quantity of gas that shall have a larg percentage of sulphureted hydrogen or ammonia?
Pour dilute sulphuric acid upon enlphide of iron, produce sulphreted hydrogen. Use care. as it it is
poisonous. For ammonia expose aqua ammonia to the ir or gently heat it in a a retort.
(2020) C. F. H. asks: 1. What would
in or bethe effect upon a bottle of water securely corked of $55^{\circ}$ below zero? A. The water would become ice. alcohol at the same temperature? A. Yes
(2021) H. C., Egypt.-I wish that you could advise me through your columns what is the have just got one and wish to know what speed it $r$ r quires to run at. A. We have no information as to th size of the helved hammer. Their speeds should var with their size and the kind of work. A small hammer
80 to 120 strokes per minute. Large ones, with 5 or foot arm, from 45 to 70 strokes per minute, accordirg to the nature of the work
(2022) W. T. K. asks : How to keep lemon juice without spoiling? A. Keep in a tightly
corked bottle. One or two grains to the gallon of salicylic acid may tend to retard fermentation, but the nended.
(2023) C. F. H. writes: 1. I have some drawing models in relief, in paper; will you kindly
give me some receipt for applying some liguid to the give me some receipt for applying some liquid to the
surface to reetore the white appeara ace? I have tried whiting, but it rubs off. A. Cunada balsam, or even gum water. may be mixed with whiting and applied as paint. 2. Is there any way to remove superfluous harf from the
face wihout injury to the skin? A. It can be done by ace without injury to the ekin? A. It can be done by electrolysis. See
Nos. 176 and 353 .
(2024) C. R. D. writes: I have been making a mercurial barometer, and find dificiculty in ex pelling air and moisture. Have succeeded fairly we
by placing the tube filled with mercury in boiling water Wonld like to know how to build farnace, in order to boil the mercury in the barometer tube. A. Use an
alcohol lamp. If your tube is of small culiber, you may succeed in boiling the mercury, but you run much risk of breaking the tube. There should be no trouble from moisture. If the tube contaius any, you will be almost
certain to break it in the boiling operation. Conduct ertain to break it in the boiling operation. Conduct
the latter operation over a arge china basin to catch the
(202j) C. F. J. asks: What substance would be readiy solube in sea water, and not at all affected by the heavy oils? A. Any number of salts,
such as chloride of sodium, chloride of calcium, sul. (2026) D. E. W. writes :

1. I have just lamp, and have been trying to light it with a battery oonsistng of 3 cells, each containnng 1 zinc and 2 carbon plates, each $2 \times 6$ inches. using a bichromate sonat an
but do not succeed. The battery will readily heat an inch of platinum wire red hot. Is this battery to small? if so, please tell me how many cells to add. Your battery is too small. Six cells may operate the lamp, but it is probable that eight will be required. 2 . Can you tell me a simple way of connecting an electric
bell with short line of telegraph, using the same wire bell with short line of telegraph, using the same wire and batteries ? A. See SCIENTIFIC AMERICAN. currenter
volume, page 123. 3 . What ize wire do I want to use to connectup an incandescent lamp with a battery? A. For a hort distance No. 18 will answer. 4. How shall
I connect my battery (in series or parallel) to light an I connect my battery (in series or parallel) to light an
Edison 4 candle power low volt lamp? A. Series. 5 Edison 4 candle power low volt lamp? A. Series.
What is the amperage and internal resistance of a bichromate battery? A. Reeistance varies from $1 / 2$ ohm
per cell upward. The E. M. F. is 2 volts. According per cell upward. The E. M. F. is ${ }^{2}$ volts. According
to ohm's law $\frac{E}{R}=C$ in amperes. $E=2, R=0^{\circ}$, there.
fore $\frac{2}{0.5}=4$ amperes. When any external resistance is incluced, the result will be different. 6.18 bichromate of
soda as strong as bichromate potash when used in a bat tery? A. Yes. . Will you please explain the following terms: Ampere, volt, electro-motive force, watt, inter-
nal and external resistance, ohm? A. You should study some elementary work on electricity to learn the meaning of these terms. You will find them in almost any
modern work on electricity or physics. 8. How fast modern work on electricity or physics. 8. How fant
can I decompose water with a battery of three cells zinc and carbons $2 \times 6$ inches, bichromate solution? $A$ So as to form about 100 cubic centimeters of mixed gases lead (such as can be bought at a hardware store), rough ening the surface and coating it with red lead, and plac. ing the whole a yart or and an jar wit phuric acid? A. Yes. 10. Can I light the 4 candle
power incandescent light (low volt) with the storage power incandescent light (low volt) with the storage
battery mentioned above? It so, will the quart size do? How long will it take to charge it? A. It will require quires from 7 to 10 hours' chargiug.
(2027) W. P. R. writes: 1. I saw a re eipt for removing supertluous hair, viz., a strong solularcl. Now what huid is used to make in porer tarch. Now what fluid is used to make it into paste
A. Water. 2. A receipt for making a good brown nnk . Use an aniline brown of the desired shade dissolve in water with enough gum arabic solution added to ing yellow spots from marble. Several formulas have been devised. Generally a mixture of sof tsoap or alka with whiting or equivalent 15 applied and left on 1 some hours. One reads as follows: Washing soda
parts, pumice stone ground 1 part, finely powdered chalk er. Rub over marble an ture of 1 ounce ox gall, 1 gill of lye, and 1 1/2 tablespoon fuls of turpentine made into a paste with pipe clay is
left upon the stain for several days. Common clay left upon the stain for several days. Common clay
saturated with benzine may be used to absorb grease. In all cases allow the mixture to remain some time upon
the marble. 4. Is benzine used to clean qraese from

(2028) J. M. T. asks : 1. Will the law reuire me to take out a license for the selling of an arti. ent not yet allowed? A. No. 2. Can you give me recipe for making the gold and siver ink such as is
used in the crown lining of hats for trade marks? ell how to use it and what kind of type to use? se true gold, Dutch gold, or silver leaf. Dust some ay on the leaf, and print the design by pressiung on ho
lat mper. boiled linseed oil and lied by a metal or rubber stamp.
(2029) W. H. L. asks: Why does the vaint on some buildings crack and peel off, and is there ny known preventive? A. Outsides of buildings that
have been many times painted will blister and pee nder the heat of the the painted will blister and pee as on the inner surface of the new paint; the old paint being weathered and partly decomposed, easily parts
from the new coat. In few cases the surface of rom the new coat. In a few cases the surface of
he wood beneath the paint separates from the paint by difference in expansion caused by great changes in temperature and a poor priming coat. It can be prevented
when the first or priming coat is an oil paint and the the first or priming coat is an oil paint and
(2030) M. A. X. asks : What indicated of at $\%$, running 250 revolutions, under 80 pounds boiler pressure, feed pipe well protected with asbestos? What
is actual horse power? Please give simple and plain din engive $A$ Your about the actuar horse power power. Its actual horse power will be its indicate horse power less its friction, which may range from 5 to 8 per cent, say about 80 horse power. The computa-
tion is : multipl the square of the diameter of the pison by 0 -7854, aud this product by the mean pressure feet per minute. Divide the ant for the indicated horse power. The pressure due to cut-off in your statement is $922 / 2$ per cent of the boiler pressure, and for all other points of cut-off is tabulated In Haswell's " Engineer's Pocket Book," which should be in the hands of every engineer. We mail it for the
price, $\$ 4$. The computation of mean pressure requires price. $\$ 4$. The computation of mean pressure requires
he use of logarithms, while the tables afford a ready (2031) J. G. writes : 1. Will dry plates that have been spoiled by light do to make photo. reliefs?
Can spoiled plates be ured in any way? A. Spoiled Can spoiled pates be used in an way? A. Spoiled
or "light struck " dry plates are useless. 2 . I have a lot of old copper plates that have been used to amalgaunate cold in a quartz mill; now is there any wa can sepa way of economicallly yeparating goid as you speify.
The plates sould be dissolved in nitric acid or could The plates could be dissolved in nitric acid or could
he oxidized by igniting in a proper furnace, and the be oxidized by igniting in a proper furnace, and theo
he solution effected in sulphuric acid. The latter is cheaper
(2032) A. W. E. asks : 1. How many feet o the ohm of commercial copper wire No. 36 , of No. 2 ohm. German silver No. 24, 2.9 feet (approximately) This length differs with different specimens. 2. How namo described in No. 161. for the armatu:e? A. Seven pounds on the field magnet and about $1 / 2$ pound on the
armature.
2. Are the tangents of the deflections of the
 tangent galvanometer proportional to the number of
amperes or the number of volts? A. Amperes. 4. Is not the heating of wire due to the number of amperes, and not volts? If so, how can the expanision voltmeter de
,
Volts and amperes cannot be separated. If $\frac{\mathrm{R}}{\mathrm{R}}=\mathrm{C}$
$\times \mathrm{R}=\mathrm{E}$. The instrument may be constructed a
(2033) S. E. M. writes : 1. Will you state or secondary batteries, and the materials used with the clay? A. Thateries, and the materials used with the kiln. 2. May such cups or plates of the same ma than is given to such cups and plates as ordinarily made, and if so, by what process ? A. By mixing saw creased. 3. Is there any treatise upon the manufacture of the article? A. We know of none, and it is no
easy to find out the approved formulas in practical use (2034) O. L. J. asks : 1. The wire for the armature ring is to be varnished with shellac and left to
dry before winding on the spool. Will it make auy difference if $I$ do as follows? Shellac the paper ou th lac this layer of wire and let it dry, Wind sothe layer, shellac, and let dry, and so on until the required thickness is obtained. What is the object of shellacking the wires? A. Your plan will answer. The wires are
shellacked to prevent Foucault currents in the armature
core. 2. Can the motor be run by a set of sulphate of
copper batteries, using copper and zinc platees? If so copper batteries, using conper and zinc plates? If st,
how many cells should I I use, and what size of plates Would this require any difference in constructiou motor? A. The sulphate of copper battery is not wel adapted to running motors. A motor to be run by a
sulphate of copper battery should have the same re sistance as the battery. 3. What size of wire should I 1se in connecting the battery with the motor? A. No 1.024 millimeters Am. W. G.
(2035) G. R. B. asks : How can I put a brown finish on a gun barrel or rifle? A. Mix 16 part ron, 12 pats butter of antimouy and 16 parts sulphat of copper. Let it stand 24 hours, add 500 parts rain water, and it is ready for use. The above plied to the perfectly clean and polished barrel, in whose cleaning lime water may be used and allowed stay on for 24 hours. One or more repetitions of the wocess will be necessary. Finally clean up and poilis.
with sweet oil.
(2036) A. W. writes: 1. I want to find out, if possible, how to make an ink (black) or paint
which when drawn with on common blank paper will fade when neated, or a composition for a crayon which will write black on blank paper and which will dieappear entirely when heated. A. Use a dilute solution of starch colored with a little iodine. 2. I would like to know how to soften common colored crayons, such as
are used for blackboards in schools, so I can use them are used for blackboards in schools, so I I an use them
on blank paper for sketching, etc. A. You cannot ,
(2037) W. R. W. asks how an induction oii is made with $a$ brass regulating tube. A. The coil is made in the usual way. It is supported at one end,
and the regulation is effected by slidiug a brass tube erterior of the secondary coil.
(2038) G. W. M. asks (1) what to apply type on which kerosene has been spilled to make "take" ink. A. Kerosene ought not to interfere
Brush off with bolling water and a stiff brush. 2. Re rer me to some good work on wood engraving, suitable for one learning the art. A. We recommend Brow's
""Wood Engraving," \$1, also Emerson's "Wood En raving," sl.
(2039) C. C. L. asks how to make carbon paper such as is used in writing on yellow telegraph operator's paper. A. Mix by heat beeswax, lard oil,
and lamplack or other solid pigment, and apply to the per with a hot iron
(2040) G. W. C. asks the physiological process by which we feel a soreness of the muscles the
day after prolonged and unusual exertion. A. It is presumably due to a phase of infla
(2041) W. B. R. asks for a white substance that will dissolve in gelatine, which 1s transparent, so it can be used as a substitute for opal glass transparench
A. Your best line for experiment would probably be o use shellac or some similar gum dissolved in alcoho and added to the gelatine.
(2042) P. J. W. asks the best method of restoring the luster on an old gutta percha walking cane that has become dingy and scratched from usage. A
Use very fine emery followed by rottenstone and water Blotting paper may be used in its application.
(2043) A. L. asks for a receipt for a glue that will make leather adhere to iron. A. Add about 5 per cent of glycerine to good glue, and just before
usiug add 5 per ceut extract of oak bark or tannic cid. Use thick and hot,
(2044) F. E. F. asks for a cheap fire proofing forwood. I want a mixture in which to satu-
rate large quantities of wood, to be painted afterward. rate larye quantities of wood, to be painted afterwara
A. Several formulas have been published. One is as follows: 33 parts chloride of marganese, 20 parts ortho phosphoric acid, 12 parts carbouate of magnesia, 10 parts boracic acid, and 25 parts chloride of ammo han in 1,000 parts of water. This and one or two othe by mail. Alsos see answer to query No. 986 .
(2045) C. A. McM. asks (1) how many six inch Grenet batteries it will take to run a six candle
power incandescent lann. A. 8 to 10 . 2 . Would it be better to get 12 nch same kind of batteries? A.. Not fo this lamp. 3. How many Leclanche disk batteries will number of Leclanche batteries. Probably not less than connected 6 in parallel and 10 in series.
(2046) A. F. asks: 1. What ampere and voltage is required forspark coil; wire core, 1 by 6 inches,
No. 16 magnet wire 5 pounds? A. Use four or five volt E. M. F. and one ampere of current. 2. Does it lose amperes all it gains in volts? A. No. 3. How long
spark (spank monhta get a $1 /$ spark from the coil you describe
(2047) E. D. asks regarding the lasting qualites of artificial ice and natural ice; which wn A. One will last as long as the other, all things bein
(2048) J. D. writes : Dynamite is said to " blow down." Is its force any greater down than in
any other direction? A. No; its energy is equally ex pended in all directio
(2049) L. M. T. writes : 1. I have made small dynamo machine as described in Screstrif of the Siemens type, wabbles slightly, and is also loose in its hearings, so that when running at a
moderately high speed, it vibrates. Would this be moderately high speed, it vibrates. Would this be
detriment to the machine in its not furnishing as muct current as it would if it were not in the condition de cribed? A. Without doubt the machine would give in order, so that it furnished the amount of current designed for it to produce, would it "form" and lead, 10 inches wide and 3 feet long, wrapped up in spiral form and immersed in 1 part sulphuric acid an

10 of water, and having about 10 square feet of active
surface? If so, how is it done? A. You can form the battery by connecting it with the dynamo for six hours, hen discharging it and again connecting it with the aynamo in the opposite direction for about 5 or 6 hours, posite direction for battery and charging in the opuas been charged and discharged 10 or 12 times. The battery should always be charged in the same direction
after formirg. 3 . Why is it that when the connections are made on the machine as described in said Scienstific Anerican Supplement, No. 161 so as to shunt tific Amercan suplement, No. ibl, so as to shunt
the current off the machine, $i$ i. e., oy placing a wire the enen the binding posts and running a w wre from
beach of said posts. that the current will not flow each of said posts. that the current will not flow
through the wires leading from the posts, but flows through the most direct route back through the armature and field magnets, and thus throwing the belt off? dynamo machnes? A. The current always takes the path of least resistance. Resistance is generally used in connection with shunt-wound dynamos. It is placed
in the field magnet circuit, and is varied for the regulathe current.
(2050) Dynamo asks : 1 . Would not a solid iron casting do for the field magnet of the simpler
electric motor? If so, what kind of iron would be the best to make it out of? A. A casting of soft gray iron will answer for the field magnet of the simple motor.
For convenience in winding it might be made in the or convenience in winding, it might be made
pieces well fitted and bolted together at the ends
forming the armature ring, would an iron ring do just as well as the wire? If it shonld, what kind of irou
would be the best? A. Iron wire is preferable to solid ron for the ring. 3. As the armature ring is insulated not tape, why would not a woodenring ao just as well? Not that want to make it that way, but as it is iusu-
lated, what good does the ring do? A . The iron inreases the inductive effect of the field . There magnet, instead of having only 33 ft., I have got $361 / 2$ ft. in it? Will the extra 3 ft. make any difference? A. It
will make no materiol difference 5 . In widnding the will make no material difference. 5. In winding the
field magnet, what is the reason it has such magnetic field magnet, what is the reason it has such magnetic
force when it is insulated with tape and the wire is *ered? A. See last clanse of answer to No. 3
(2051) F. F. C. writes: 1. It is stated in Tyndall's pamphlet on elementary lectures in frictional
electricity, that " "Frictional electricity has to pass electricity, that Frictional electricity has to pass point to another.
ubes of Cavendish ho one nercurial surface over to the other? Or is not the
space above the mercury in barometer a perfect vacuum? the mercury it bace above the mer cury in a barometer is not a perfect vacuum. It contains a little air and vapor of mercury. 2. In Hopkins'
"Experimental Science," pages 430 and 431 , it states "Experimental Science," pages 430 and 431, it states
that when 12 cells are connected in series, each having a resistance or $b$ onms, the total internal resistance will be 60 ohms ; and when the same cells are connected parallel, the resistance of the whole battery is difference in the two arrangements? $I$ should think the internal resistance in the second case would be 5 ohms internal resistance entere second case would be ohms
for the whole battery. A. The statement is of the Consider each cell as representing a piece of wire of ohms resistance. Twelve such pieces put in paralle would give twelve times as good a passage for the current as asingle one. Twelve pipes in parallel would single one. 3. What chemical changes causes molasses candy, while hot, when pulled to become a lighter mechanically included in the grain, owing probee is no chemical change involved. 4. Why does not copper with sulphuric acid give hydrogen instead of sulphur dioxide, while zunc and sulphuric acid gives hydrogen A. Electro-uegative metals having low affinity for
oxygen all act in this way. They cannot decompose axygen aif act in this way. They cannot decompose readily the molecule of water, but can reduce sulphuric oxide. Zinc in sulphuric acid attacks the water
molecule only. Why it does not reduce the sulphuric (2052) J. F. M. asks : 1. How to mend
rubber boots so they will stick and not come off. A. rubber boots so they will stick and not come oif. A.
Use Irdia rubber cement or gutta percha idisolved in
bisulphid of carbon. See our SUPPIEMENENT, Nos. 249 sulphiae or carbon. see employ heat to put on the patching? A. Yes, if gutta-percha is used; very little if India rubber cement.
(20戸3) A. J. K. K. asks: Is there any flexible tubing, like rubber tubing or other material,
made that will stand the action of gasoline? A. Good Gality vulcanized rubber tubing will do this for a con siderable time.
(2054) J. M. C. asks: 1. Will you kindly tell me how to treat new cotton cloth (cheese
cloth for example) which upon contact with water impervious to it, so that the cloth will instantly absorb upon contact? A. Boil in a five per cent solution of caustic sod, followed by boiling in a five per cent solu-
tion of bleaching powder. Immerse in dilute muriatic ton of bleaching powder. Immerse in dilute muriatic
acid, wash, treat again with soda and wash. Probably acid, wash, treat again with soda and wash. Probably
a single treatment with soda followed by washing wil nswer your purposes. 2. What material wha absor he greatest amount of water as compared to its bulk?
A. Cotton prepared as above (absorbent cotton of the
(2055) M. R. asks: 1. How to mak hole in the bottom of a perfume bottle? A. Drill it with a file whose end has been broken off, so as to give carpenter's brace or drill stock Use turpentine and camphor as lubricant. 2. How or where to get best in ormation on copper and steel plate engraving and rinting. A. Several manuals have been pubished,
treating of such subjects, which we can supply by mail (2056) J. H. F. asks : 1. A simple test for the detection of acid in illuminating oil. Something or the ourate than litmus paper. A. Shake a sampl o
It
show an acid reaction, evaporate on a water bath until show an acid reaction, evaporate on a water bath until
concentrated. If it still shows none, the oil is fre from sulphuric acid. Or the water may be evaporated withalittle white sugar on a water bath. Sulphuric acid
if present will darken or blacken the sugar. 2. How many volumes of gas or vapor will one volume of crude oil produce when distilled? A. This all depends on the circumstances of the case. At a high temperature on hundred or more cubic feet may be produced. By definite answer cannot be given. 3. A tank of oil is four inch pipe half way down the hill, and, a six inch pipe the balance of the way. will this dischargemore oil than it would if the position of the pipes was re versed? A. It 18 immaterial. 4. Suppose a still is dis
charging gas through a two, three, or four inch pipe say 200 to 400 feet long, with the gas burning at the end of the pipe. If a partial vacuum was created in the still, could the fire travel back through the pipe and ex
plode the still? A. Yes; even if no explosion took plode the still? A. Yes; even if no explosion took
place, a very volent fire might be produced in the still, which might produce very serious results.
(2057) R. T. D. writes: I live in a England, sometimes arrives soared and unfit to drink. not it be converted into table vinegar? A. No. Th percentage of alcohol is too low.
(2058) M. H. C. asks : 1. Please tell me themost convenient and practical way for cleaning oi cloth. A. Wash with soap and water. 2. What is the
best manner to clean hair brushes? A. Wash with weak solution of washing soda. rinse out all the soda and expose to sun. 3. Give names of the materials and the proportions required for the Leclanche cell. A Outer cell, zinc rod unamalgamated in solution of sa ammoniac; inner porous cell, a plate of carbon sur rounded by a mixture of 60 parts eraphite and 40 part pyrolusite (binoxide of manganese), both well sifted fre
from dust.
(2059) A. O. C. asks for the process of making rubber combs. A. The rubber is vulcanized in you to our SUPPIEment, Nos. 249, 251, and 252, for
(2060) S. P. A. asks: Do stone and other minerals grow in size? A. They do not, properl speaking. The genesis of minerals is a very compre hensive study, and involves a knowledge of many com-
plicated reactions. Minerals are constantly being plicated reactions. Minerals are constantly being
formed in the operations of nature, one mineral changing into another by loss of some of its constituents or other changes. Carbonates are continually bein deposited from water holding them in solution, and eve the acid products of decaying vegetation play an important part in mineral history
(2061) A. W. P. asks: 1. Could the 8 light dynamo described in Supplement, No. 600, be used to charge a storage battery at a distance of 40 o sufficient size, say No. 9 or 10 copper wire. 2. Could a sufficient number of batteries be used to light the same number of lamps as from dynamo direct? How
many storage batteries would be required? A. You can light the same number or a greater number. To run 50 volt lamps you should have 26 cells. For 20 volt lamps, 11 cells. These will run respectively 25 and 10 lamps or any smaller number. 3. Could enough current be generated during 10 hours of the day to light 8 50 volt lamps for 3 or 4 hours each night? A. Yes; you What size and kind of wire would be required from dynamo to battery and also from battery to lomps? A See No. 1. The distance of the lamps from the batter f near No. 16, would answer. 5. Is there a book on the above subject? A. Consult Badt's "Incandescent Wiring." 6. What kind of battery would be hest for unning simple electric motor described in "Experimental Science ${ }^{\text {" }}$. Would the large Bunsen ceil, called y dealers nickel plating battery, run it? How many nn it to its full capacity? A. The large Bunsen would answer very well. Yo
nected two in parallel.
(2062) N. B. asks : How is tin stained different colors, as seen on trunks? A. Use as a body add to it $1 / 2$ part of boracic acid to 1,000 parts of lacquer. Color with suitable pigments, such as gamboge, Prussian blue, or carmine. Aniline colors may be used, but tend to fade. Excellent results may be attained by adding a little castor oil, which makes the lacquer much
tongher.
(2063) J. C. G. asks: 1. Is it as safe to walk on an electric railroad track during a thunder storm as anywhere else? A. Yes. 2. Are houses two
hundred feet from the wires anywise protected by them? hundred feet from the wires anywise protected by them?
A. Not to any perceptible extent. 3. A re persons with A. Not to any perceptible extent. 3. Are persons with than anywhere else during a thunder storm? A. They are rather more exposed than elsewhere
(2064) F. E. D. asks for a receipt for oftening hard water, the same to be used for bathing
purposes at our gymnasium. We use hard water which is not the best for bathing purposes. A. The proper treatment depends on the nature of the water. If due to gypsum, it cannot be cured. If due to bicarborate of lime, an addition of an equivaient of lime to each equivalent of the bicarbonate wili precipita
after which it should be allowed to settle.
(2065) E. B. asks : Please tell me which is the best way to make beer clear (clean) and also give it a red color. A. Dissolve 1 ounce isinglass in 1 quart weak vinegar or hard beer, add good beer enough to
make 1 gallon. This is called finngs. To use it take for a barrel of the beer 1 or 2 pints and beat it up with about a gallon or two of the beer in a bucket until it is frothy, then add to the liquor in the barrel.stirring well through the bung hole. Do not use artificial color. Caramel (burned sugar) will darken it.

## TO INVENTORS.

An experience of forty years, and the preparation or
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