

TWELVE HUNDRED HORSE POWER CROSS COMPOUND ENGINE-BERLIN POWER HOUSE.


THIRD RAIL ELECTRICAL EQUIPMENT N. Y. N. H. \& H. RR.-BERLIN POWER HOUSE SHOWING BOILER SETTING.-[See page 408.]

## §rientifir ${ }^{2}$ mmerican.

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## american institute fair.

The managers of the American Institute Fair, which is to be held from September 20 to November 4, at Madison Square Garden, intend to put forth special efforts to make this one of the most interesting fairs in the history of the institution. As our readers are doubtless aware, the American Institute is one of the oldest organizations of its kind in America. It is now verging on its seventieth year. During its long life it has been one of the most powerful factors in the promotion of invention and industry in the country Many of the famous inventions of the past forty years received their first recognition at its hands, and to secure the institute medal was one of the most coveted indorse ments which could be given. It is the intention of the board of managers and the general superintendent of the fair, Mr. Alfred Chasseaud, to make the department of engines and machinery the strongest in the whole exhibit. It is to include a very wide variety of prime movers, and particular attention will be given to stationary engines operated by steam, gas, water, or wind. There will also be a large exhibit of pumping machinery, steam fire engines, iron and wood working ma-
chinery, textile and paper machinery and that used for chinery, textile and paper machinery and that used for the manufacture of leather and rubber. We are glad Madison Square Garden, and the scale on which it is to be carried out indicates that the renewed life and vigor which marked the operations of the institute las year is likely to be permanent.

## the engineer motor car competition.

The celebrated motor car competition organized by The Engineer, of London, has resulted, according to our contemporary, in a miserable failure, only five ve hicles putting in an appearance at the Crystal Palace, London ; and even this pitiful remnant of the original seventy-two entries was, in the opinion of the judges, so lacking in the qualities that go to make up a really useful and reliable motor that they made no award, and the six thousand dolars which was to have been
awarded in prizes was handed back to the promoters awarded in prizes was handed back to the promoter
of the competition. The first offer of a prize of one thousand guireas was made about two years ago, and the conditions, as formulated a few months later, announced that prizes would be awarded "for the encouragement of manu Engineer "believing that an important trade may be created in this class of machinery, and that the removal of the restrictions on the use of mechanically moval of the restrictions will result in great benefit to the propelied
In the course of a pessimistic editorial, The Engineer congratulates itself on the fact that although the essay has failed in its original purpose, it has "cleared the air" and shown the true facts concerning the so-called motor car industry in England. "There is at present no such industry. There is no such thing as a thor oughly satisfactory self-propelled vehicle. If a moto car of the kind existed, it would have been submitted and not altogether warranted by the facts. In the first place the competition was narrowed down by the exclusion of all vehicles propelled by light oil or petroleum spirit, against which The Engineer has shown a per sistent prejudice from the very first, although on its own admission "very little success had been obtained with vehicles which did not use petroleum spirit." This prejudice was so marked that it is not surprising that the subsequent offer of a special prize of five hundred and twenty-five dollars for vehicles using ght oil admitted to be the only successful motor car on the market. Everybody that keeps in touch with the motor car industry is well aware of the defects of oil-driven motors, and none more so than the makers themselves. But for The Engineer at this early stage of the work to sweep aside three-fourths of the inventors and their machines, and suppose that it can be determined by an ex cathedra mandate what shall and what shall not be the surviving type of motor car, may be
agreeable to the traditions of that jourual, but, as the agreeable to the traditions of that journal, but, as upon the motor car industry at large.
In defense of the course it took it is explained that it had no particular desire to develop pleasure carriages, as its "purpose was utilitarian," and it is pointed out that the unpleasant odor which comes from most oil motors would prohibit their commercia use in a crowded city. But in taking it for granted that this difficulty is incurable our contemporary as sumes altogether too much, and the most that is proved dustry cannot be arbitrarily controlled so as to pro ceed along certain prescribed lines of development
Although The Engineer claims too much in stating that there is absolutely no motor car industry, it has done the British public good service in showing that the industry has no such proportions as to warrant the company-promoting speculations;which have entrapped the unwary investor.
In the next issue of the Scientific American Sup-

PLEMENT we shall give illustrations and particulars of some of the motor cars which were present on the morning of the contest, including the two which re ceived favorable mention from the judges.

FALL OF A NEW BUILDING IN NEW YORK CITY.
The collapse of a building on Fifty-second Street and Twelfth Avenue has again drawn attention to the risk which are liable to be incurred by the erection of mas ive water tanks on the top floors of a building. When the tanks themselves and the supports which carry them are properly designed, there is, of course, no more isk than is involved in carrying any other form of static load at the top of a building. As a matter of fact, however, this construction is too often very faulty and marked by an ignorance or carelessness, or both, which has brought many a well constructed building to grief. The most frequent disaster from roof tank is that caused by a fire in the upper stories burning through the tank supports, and causing it to fal through the floors beneath. In the case of the Twelfth Avenue building the heavy load of the tank. was sufficient to bring about the collapse of an extra ordinarily faulty building. The accident happened before the occupants had moved in, and it is owing to this circumstance that the death list is not a painfully arge one.
The building, which was to have been used as a soap factory, is in the form of a hollow square, and measures about 200 feet on a side, the width from wall to wall being about 60 feet. It was five stories in height, and was built of composite construction, with cast iron columns and steel floor girders. On the lower floors the girder are 15 inch I beams, but on the fourth floor 24 inch beams, with their flanges reinforced with two $5 / 8$ inch plates were used, the girders being made heavy to carry the weight of fourteen tanks, each of which with its full load weighed nearly eighty tons. The tanks were 13 feet square and 15 feet deep, and were placed in a double row on the outside of the building, one fow of seven standing near the outer wall and th next row about ten feet from it and close against an interior row of columns. The collapse took place while he tanks were being tested for leaks. They were approximately full of water when, without any warn ing, five out of the seven in the outer row fell through the building, carrying the floors below with them, and, of course, throwing down the outer wall at the same time. The accident will call to mind the fall of the Ireland building, on West Broadway, where the same class of construction was employed, and although in that cas the wreck was primarily due to faulty foundations the debris showed all the usual defects in the cast iron columns.
The great gap in the outer wall is very suggestive as to the origin of the disaster, and a closer inspection of the wrecked iron work, and of the plan of construction as shown in the work which is still standing, makes it easonably certain that it was the columns in this wal that failed. These columns were of square section with flanges for bolting them together at the abutting ends. They were built within the wall, but considered as part of a framed structure for carrying weight, they were virtually without bracing. On one side, that next the tanks, they were theoretically held in the plumb position by the 24 inch I beams which were bolted to ugs cast on the columns, but on the other sides they had no metal connections whatever. The stiffening afforded by the I beams was of doubtful value, for the heavy load which they carried was transferred to the columns eccentrically by means of the small lug above referred to. This would set up cross bending strains of a kind which are very undesirable in any nember subject to compressive strains, and especially o when the material is cast iron.
In the course of some tests on full size cast iron columns recently carried out at the Yorkshire Engineer ing College, Leeds, it was found that, when the load was applied to side brackets or lugs such as we are considering, the column failed by a diagonal trans verse fracture whose appearance indicated that it wa the bending effect of the eccentric load that produced the failure. A load applied from the side cannot be reated as a load applied in the direction of the axis of a column, and a very liberal allowance should be made for this in determining the cross section of the member.
In addition to this predisposing cause, the throwing of the columns out of line is rendered easy in this form of construction by the unsatisfactory nature of the con nections, which usually consist of simple flanges, in the present case held together by only four bolts. Whil it is true that this might be sufficient to keep the columns in line when there was no load or a ligh oad upon them, the flimsiness of the connection is apparent when we remember that, in addition to the various floor weights, a load of over 40 tons of tank and contents was carried by each vertical line of columns. The danger of collapse will be evident if we consider the outer wall (which carried none of the weight) to be taken away. The columns would then be left entirely unbraced on three sides, perfectly free to buckle at the joints in the line of the wall, and only
kept from buckling outward by a few bolts fastening column to girder.
lt is to be hoped that the day is coming when cast iron will be entirely replaced by steel in buildings of a iron will be entirely replaced by steel in buildings of a
composite character. Its great compressive strength is more than off set by its low shearing and tensile strength and its uncertain behavior renders it altogether unfitted for use where the strains are more or less complicated and where, as in the present case, the lives of many scores of operatives are at stake.
If cast iron is to be used at all in the skeleton of a composite building, it should be used with great care and careful judgment. The abutting ends of posts and coiumns should be in all cases carefully machined, and the flanges and flange bolts should be larger than are now frequently employed. Loads should be concentrically applied to wall columns, even if it involves the use of twin girders, one on each side of the column. Above all, transverse bracing of some kind should always be employed for the exterior or wall columns, and it should be attached to the columns as close as possible to the abutting joints. Where heavy superimposed loads are to be carried the wall should not be entirely depended upon to furnish lateral stiffness. There is liable to be poor contact between wall and columns, and a small clearance would be sufficient to allow a fatal lateral movement of the column line.
It is sincerely to be hoped that the lessons of this disaster, which might well have been one of the most calamitous on record, will be noted by the building departments of this and other cities, and that, if cast iron columns continue to enter into building construc tion, they will be subject to a most searching scrutiny by expert professional men.

## charges against a patent firm

Owing to the large number of complaints from in ventors received at the Patent Office relative to the alleged unprofessional methods used by Wedderburn \& Company to obtain clients and their neglect to serve them properly before the department, Commissioner Butterworth has summoned the firm to appear before him and answer numerous charges of unprofessional conduct. A hearing is to be had before the Commis sioner in a few days, and if the charges are sustained they will be debarred from practicing before the Patent Office.

## ANOTHER TRANSATLANTIC STEAMSHIP SERVICE.

After some years of unsuccessful agitation of the question of a subsidized express steamship line between England and Canada, it now seems that the Canadian fast Atlantic service is to be established on a permanent basis. The contract has been signed by Messrs. Peterson, Tate \& Company, of Newcastle, who are the parties interested. Four vessels are to be provided, each of which must be able to maintain an average speed of 500 nautical miles per day, or about 21 knots. The contract calls for ships 520 feet long and of 10,000 tons register, and they are to be equal in every respect to the best steamers in service on the Atlantic to-day Each vessel is to accommodate 300 first-class, 200 second class and 800 steerage passengers, and must possess a cargo accommodation of 1,500 to 2,000 tons, 500 tons of which must be cold storage.
Two of the ships are to be ready by May 31, 1899, the other two by May of the following year. The ships will be run fortnightly during the season of 1899 and weekly during the season of 1900 . The starting point will be from Liverpool, and during the summer month the ships will run to Quebec and Montreal as long as the navigation permits; during the winter season they will run to Halifax, N. S., or St. John, N. B., accord ing to the option of the contractors. Vessels are to call at an Irish port, if required to do so by the gov ernment.
Messrs. Peterson, Tate \& Company will receive a subsidy of $\$ 773,000$, one-third of which will be paid by the British government and two-thirds by the Cana dian government, and the contract is to cover a term of ten years.
This addition of four first-class express steamers to those already afloat, together with the giant Oceanic building for the White Star Line, and the truly splen did twin ships of the North German Lloyd Company which commence active service this year, will giv transatlantic passengers the choice of over a dozen
boats that are of 20 to 22 knots speed and furnished with the latest luxuries of ocean travel.

## national electric light association.

The twentieth convention of the National Electri Light Association met at the International Hotel, Niagara Falls, N. Y., on June 8, 9, and 10. There was a very large attendance, three hundred members being present, and nearly one thousand visitors who were in terested in the proceedings were also at Niagara Falls. The meeting was called to order by President Frederic Nicholls at 10:45 A. M., ọn June 8. Letters of invita tion were read from the various companies located in Niagara Falls and the vicinity which invited the mem-
bers to visit the various plants. Letters of regret from

Lord Kelvin and others were read. President Nicholls made an interesting address and the reports of the committees and reading of papers followed. Each day of the convention was filled up with the transaction of business, the reading of papers, and excursions to the interesting places and plants in the vicinity. The following were the principal officers elected : President
Samuel Insull, of Chicago; first vice president, A. M. Young, Waterbury, Conn.; second vice president George R. Stetson, New Bedford, Mass.

## the aeroplane flying machine.

Owing to the wide interest excited by the many articles on the mysterious but elusive airships with which the daily papers have been filled in the past few months, it may be of interest to the ScIENTIFIC AMERI CAN's readers to learn that though these "news items" were all the creations from the brains of imaginative persons, yet scientific experiment has been carried on by many able inventors in working on what may be called the true flying machine; that is, one which is hundreds of times heavier than the air upon which it rests, by reason of its dynamic impact, and not by the aid of any balloon or gas bag whatsoever. This line of experiment has resulted in such great progress in the last few years (and especially so in the last six wonths) that the attainment of long, free flight for man, which not long ago seemed an invention for the hand.
Of all the experimenters who have attacked this problem previous to the last decade, but very few indeed have seemed to have known and comprehended the nature of the real difficulties which were to be met with in the securing of the flying machine; i. e., the difficulties involved in obtaining automatically a saf equilibrium, and in securing horizontal flight. Perhaps the greatest genius who ever worked on the flying machine problem was M. A. Penaud, a Frenchman, who in 1871 produced a screw-driven flying model provided with a small rear surface which acted as a reguator. This regulator controlled his model to such an
extent that its average flight, as a whole, was horizontal, but its course however, was composed of a number of undulations. It has been pointed out, and insisted upon by several writers, that in the elasticity of its surfaces it contained the fundamental principle which made this regulation possible-but this is not the case for actual experiment distinctly proves that a Pénaud model will fly farther and is more stable with perfectly rigid surfaces than with those which are flexible. This
regulator does not maintain a horizontal equilibrium except in very mild winds. Yet this model should stand out above all others, because it was the first dynamic aeroplane provided with an automatic regu lator that actually made free flights. These were up to 131 feet in length and lasted on some occasions a much as eleven seconds. Pénaud calculated that it ustained 81 pounds per horse power. ${ }^{*}$ (His model weighed a little over half an ounce and had half a quare foot of sustaining surface.)
As his model exposed 15 square feet per pound weight it is evident that a practical machine on this basi could never be built. Besides that of Penaud many dynamic aeroplane models have been produced in the past by Tatin, Moy, Stringfellow (whose model is now preserved as a historical relic in the National Museum indefatigable worker, who produced noless than twenty models which would actually fly, the most of them being actuated by rubber springs, but some by stean and a few by compressed air. One of the latter type,
which was presented in ee years ago to the Field which was presented in ee years ago to the Field
Museum, of Chicago, is on exhibition in this country. It is remarkable for the fact that it sustained a hori zontal flight for 19 seconds, during which time it covered a distance of over 300 feet and carried in flight a little over 75 pounds per horse power. $\dagger$ Its surfaces, however, are unduly large, $61 / 2$ square feet per pound weight. (A practical machine will probably be required to sustain from six to fifteen times this load ing.) Mr. Hargraves is the inventor of the cellular kite used by the weather bureau. He is purely a scien tific experimenter who has given his valuable work to the world without reserving to nimself any patents
Besides the above mentioned the writer, in 1890, pro duced a rubber spring driven model which attained horizontal flight through the action of an automatic regulating device, working on a new principle, but in outward appearance somewhat similar to that of Pénaud. This model sustained 157 pounds per horse power with 6 square feet per pound weight. $\ddagger$ It flights lasted from six to seven seconds, during which
*Even if we accept Penaud's figures and reduce the weights sustaine what it would have been on a model losded to 1 pound per square foo
we shculd find that he could have carried but $81+\sqrt{15}$, or say 22 pound per horse power.

+ Seventy-five pounds per horse power on 6/2/a square feet of surface he pound welght is equivalent to $29 \cdot 8$ pounds per horse power, if the model rere loaded to 1 pound per square foot.
\& One hundred and fifty-seven pounds per horse power on 6 square fee to the pound s equivalent to 60 pounds per horse power with a loading of pound per bypuare foot.
time it covered distances from 100 up to 135 feet. This model, which is still in existence, was exhibited in the spring of 1892 to an acquaintance who. some time later described its flight in a small account in one of the Rochester, N. Y., papers, and in the fall of 1895 it was exhibited also to Dr. Laugley, the distinguished secretary of the Smithsonian Institution, who took dimension sketches of it and who was so much pleased with the flights and the action of its regulator that he re quested the writer to fly it repeatedly, first with the regulator in action and then without it
In the year 1891 the writer constructed an improved and larger model (weighing 5 lb . and exposing 15 square and larger model (weighing 5 lb . and exposing 15 square feet of surface), fitted with compound steam engines and
a condenser. This model furnished the power for its own start-but its best flight was only about 240 feetalthough it carried fuel and supplies for several miles. Petroleum was used instead of water in the boiler The reason that only a short flight was obtained was due to the boiler blowing up before enough trials were had to properly adjust the regulator. The damage from the heat of the burning of the boiler's content ruined the small engines, which were built of tempered tool steel. Owing to the pressure of other affairs, this model was not rebuilt
Pre-eminent in the field of aerodynamics stands the ecretary of the Smithsonian Institution, Dr. S. P Langley, who has done more than any one else (except possibly it be the late Otto Lilienthal, of Berlin, Ger many) to place the subject on a sound basis; for his "Experiments in Aerodynamics" will hereafter be ooked upon as one of the pioneer lights which directed modern scientific effort to the subject of aerial navigation. This work, contrary to the prevalent belief of engineers, showed that in so far as the question of power was concerned, flight was possible. Dr. Langley has since then directed his efforts to the production of a model which should demonstrate that the further difficulties might be overcome. This model flie from one-half to seven-eighths of a mile, uses steam weighs about 30 lb . complete, and employs a pair of engines furnishing between one and one and one-hal horse power. It may be questioned, however, whether Dr. Langley's expressed views as to what he has accomplished, and his predictions of the future prospects and uses of the flying machine, are not too sanguine; for it s doubtful whether with the most economical heat ngines that have ever been constructed the flying nachine, carrying even one passenger alone, will ever be able to fly for a day--not days at a time or at a speed which exceeds 80 to 90 miles an hour. That it wil never carry freight is almost certain. It is even prob able that the machine of sufficient size to carry more than two persons is an invention for the relatively dis tant future. With all deference to the opinions ex pressed by so eminent a scientist, it might be pointed out that with the low economy in supporting effec obtained with this model ( 30 lb . per horse power) * it is not possible to add a condenser, and a machine built $r$ anything like a similar scale for carrying a ma ould not be able to lift its own weight! For, if w double the lineal dimensions, we would have but four times the surface (lifting effect), while we would b hampered by eight times the original weight. It may be argued that, by reducing the angles at which the urfaces are presented to the air, a larger lifting effec per horse power would be obtained. The maintenance of a small angle in flight is, however, one of the most ormidable difficulties of the whole flying machine problem. From the simple laws which govern the hrust of helical screw propellers, it might be show hat the expenditure of 1 horse power on a pair of crew propellers 39 inches in diameter (the size given by Langley) would produce a flying or a standing thrus of 16.3 lb ., or 54.3 per cent of the weight of his aerodrome. It can further be shown that with a boile pressure of 150 lb . to the square inch, the pair of engines of the size given ( $11 / 4$ inch bore, 2 inch stroke) would each produce 40 to 45 foot lb. (net) on the shaft per revolution. This much spent on a 39 inch properly nade screw would produce a thrust (flying or standing) f at least $10_{1} \frac{29}{100} \mathrm{lb}$., and the pair of engines acting on a pair of propellers would give a thrust $20 \frac{58}{100} \mathrm{lb}$., that is, $68 \frac{8}{\mathrm{f} 0}$ per cent of the weight of the aerodrome, and pos sibly more. The lower boiler pressure given, 110 lb . would give a thrust in flight for standing of 16.4 lb These thrusts are so extraordinarily large in propor tion to the weight carried on the aeroplanes that it might well be questioned if the possibilities of aeria avigation, which Prof. Langley claims to $h$
It has not been possible in an article of this length o touch upon the value of the work done by the late Otto Lilienthal nor the exceedingly valuable results published of the experiments of Mr. Hiram Maxim which, although fragmentary, are of the utmost value to the engineer.
*The dimension sketch given by Prof. Langley in the Aeronautical Annual weight is suming the power at 1 horse power, it shows 80 lb . were carrled at that weight with a loading of 1 lb . on $21 / 2$ square feet. This, reduced to a load-
ing of 1 lb . per square foot, is equivalent to barely 19 lb . per horse power ing of 1 ib . per square foot, is equivalent to barely 18 ib. per
with wilich lift neither a condenser nur man filght is poseib)

Curious Error in a Trade Mark.
An amusing piece of ignorance is shown in the case of a trade mark recently issued for rye whisky. The proprietors of the trade mark have shown a greater knowledge of art than of history. The design represents, in martial attire, the bust of the unfortunate General Braddock. The hair is arranged artistically with the conventional queue, the bristling stock and the shimmering epaulets are elaborately displayed, but the specification describes the general as depicted in the uniform of an officer of the Continental army. General Braddock would surely be a little startled to learn that he had been deprived of his rank as an officer in the British army and had been adopted willy nilly into the American army. He would, however, be still more puzzled to know how he could be translated into the ranks of an army which did not exist until twenty years after his death. We advise our friends of the "still" to brush up their history and to turn the poor unfortunate back into his regulation red coat

## AN IMPROVED ROCK DRILL.

The illustration represents a head for rock drill cylin ders in which the packing is placed at the base of the head, or close to its connection with the cylinder, whereby lateral pressure on the drill rod or piston rod will have no perceptible effect on the packing, thus preventing escape of the motive agent and prolonging the usefulness of the drill head. The improvement ha been patented by Warren Wood, and is being intro duced by the McKiernan Drill Company, of No. 120 Liberty Street, New York City. Fig. 1 shows the im proved head connected with the cylinder, Fig. 2 being a sectional view. The head comprises a casing made in two separable sections secured together by transvers bolts, the casing sections having perforated lugs by which the head may be bolted to the drill cylinder, and within the bore of the casing is a bearing sleeve made of two longitudinally separated sections, one edge o each section having a projection engaging the edge o


## the mokiernan rock drill.

the other section. The joints between the sections of the casing and of the bearing sleeve respectively are out of line, to prevent any escape of the motive agent. The inner end of the sleeve rests on the packing and at the outer end of each sleeve section is a lateral perforated lug to receive tie bolts by which the sleeve may be forced tightly against the packing. When a drill works at an acute angle it is frequently the case that a new stuffing box or gland will have to be often supplied -a difficulty which this invention is designed to over come.

## Coal Production of the United State

The compilation of the statistics of coal production in the United States in 1896, which has just been completed by Statistician E. W. Parker, of the United States Geological Survey, shows that the product in 1896 was $190,639,959$ short tons, valued at $\$ 195,557,649$ against $193,117,530$ short tons, valued at $\$ 197,799,043$, in 1895, a decrease of $2,477,571$ short tons in amount and o $\$ 2,241,394$ in value. The decrease in product was en tirely in that of Pennsylvania anthracite. The output of bituminous coal shows an increase of about one and three-quarters million tons. The anthracite product of Pennsylvania decreased nearly four and one-quarter million tons. It is a notable feature, however, that there was a decrease in the value of the bituminous product of over $\$ 1,600,000$, notwithstanding the in creased output, and that there was a comparative increase in the value of anthracite, although, on ac count of the smaller production, it did not equal the value in 1895. The average price obtained for anthra cite at the mines increased from $\$ 1.41$ in 1895 to $\$ 1.51$ in 1896. The average price for bituminous declined from 86 cents to 83 cents.
Among the important bituminous coal producing States, Pennsylvania, of course, stands first, with an output of nearly $50,000,000$ tons. Illinois is an easy second with nearly $20.000,000$ tons, or more than 75 per cent of the combined product of West Virginia and Ohio, which come third and fourth respectively. The race between Ohio and West Virginia was very close in

1896, there being but one thousand tons difference, and the output of each nearly $13,000,000$ tons. These four States yield about 70 per cent of the total bituminous production.
Pennsylvania's bituminous product was a little more than one million tons less than in 1895. Ohio lost 480,000 tons. West Virginia increased her output about $1,500,000$ tons and Illinois about $2,000,000$ tons. The other important States showing increased production were Alabama, Arkansas, Colorado, Indian Territory Kentucky, Maryland, and Texas, while Indiana, Iowa Kansas, Missouri, Montana, New Mexico, Tennessee Kansas, Missouri, Montana, New Mexico, Tennessee
Utah, Virginia, Washington, and Wyoming showed decreased production. West Virginia had the most im portant increase among the Appalachian States, Illinoi in the Middle West, and Colorado was the only State in the Rocky Mountain region whose production in creased.
The production by States is shown in the following table:

| States. | Total Production, Short Tons. | Total Value. |
| :---: | :---: | :---: |
| Alabama | 5,745,617 | \$5,171,055 |
| Arkansas. | 669,374 | 743,577 |
| California and Alaska | 93,776 | 220,523 |
| Colorado.. | 3,139,078 | 3,630,6ะ2 |
| Georgia and North Carolina | 246.359 | 179,770 |
| Illinois. | 19,786,626 | 15,809,736 |
| Indiana | 3,905,779 | 3,261,737 |
| Indian Territory. | 1,366,646 | 1,918,115 |
| Iowa.. | 3,954,028 | 4,628,022 |
| Kansas... | 2,764,801 | 3,175,032 |
| Kentucky | 3,183,478 | 2,496,806 |
| Maryland. | 4,143,936 | 3,299,928 |
| Michigan. | 92,882 | 150,631 |
| Missouri. | 2,331,542 | 2,518,194 |
| Montana | 1,484,445 | 2,176,422 |
| New Mexico. | 622,626 | 930,381 |
| North Dakota | 78,050 | 84,908 |
| Ohio. | 12,875,20\% | 10,253,461 |
| Oregon. | 101,721 | 291,564 |
| Pennsylvania- |  |  |
| Bituminous. | 49,101,148 | 35,024,918 |
| Anthracite | 53,771,890 | 81,415,785 |
| Tennessee. | 2,658,606 | 2,276.795 |
| Texas | 544,015 | 896,251 |
| Utah | 418,627 | 500,547 |
| Virginia | 1,254,723 | 848,851 |
| Washington. | 1,195,504 | 2,396,078 |
| West Virginia | 12,876,296 | 8,336,685 |
| Wyoming and Nebraska. | 2,233,184 | 2,918,225 |
| Total.. | 190,639,959 | \$195,557,649 |
| Effect on Bridges of Motive Power at High |  |  |

This subject, having been brought under the con sideration of the Association of Railway Superintend ents of Bridges and Buildings, was referred to a com mittee consisting of Messrs. George W. Andrews, J. E Grenier, and Walter G. Berg, which made its report at the recent meeting of the association in Chicago. The report is published in the Canadian. Engineer for De cember, and doubtless will be disappointing to some who were active in initiating the investigation, if a mere compilation of facts and experience previously gained by others can properly be called an investiga ion, says the Engineering Magazine.
In sum, the committee report that up to the presen time no positive law of the mechanical action and resultant effects upon bridge structures of motiv power at high speeds has been formulated, and that it is impossible to even approximately indicate the injuri ous effects of quickly moving loads on bridges.
The committee, in effect, confesses ignorance of th quantitative values of increased strains to which bridges are thus subjected. At the same time it ex presses the full belief that these effects can be meas ured, and that instruments can be made that will regis ter them. This assertion, however, is accompanied with the opinion that in so broad a field no one com mittee can ever arrive at conclusions of great value These statements are made the justification for th compilation embodied in the report as a substitute fo the original matter which, the committee seems to think, was expected, since it solicits the indulgence of he association for the deficiency. Classifying at empted determinations of impacts into (a) purely heoretical, (b) those directed to measurement of the tretch of bridge members during the passage of trains, and (c) those directed to the measurement of the deflec tions of bridge structures as a whole, the committe declares that the theoretical determinations have no interest to the association. Those in class $b$ include ests practically limited to European investigations on riveted bridges, which have shown that impacts on such structures decrease, as spans increase, "in a ather uncertain and erratic manner," and that "the mpacts in the various members of the same span are vague function of the moving load required to cause naximum strain in the member considered.
The instrument invented by Prof. S. W. Robinson or accurately measuring center deflections is favorably spoken of as one means of obtaining accurate informa tion in a general investigation of the subject. Mem bers of the committee made about one hundred tests of he kind included in class $b$. The results are not included in the report, as they are said not to have
been "sufficiently positive." The report well indicates the present imperfect knowledge of effects of impacts of moving loads on bridges.

## A CONVENIENT DRILL CASE

A case in which to keep drills, so that it will alway be easy to find just the drill wanted, is shown in the


## THE WEISS DRILL CASE.

ccompanying illustration. It is manufactured by Louis T. Weiss, Nos. 291 and 293 Graham Street, Brook lyn, N. Y. It has 60 round-bottomed receptacles, from No. 1 to No. 60, No. 1 holding sixteen and No. 60 abou two hundred drills. On the raised edge opposite each receptacle is sunk a hardened and accurately ground bushing, forming a drill gage for that receptacle, as shown more plainly in the small figure, the size of each drill appearing in decimals opposite each bush ing, and also the size of tap for which the drill is suited. One can see at a glance every drill in the case and no time need be lost in hunting for a drill or drill gage. The case is made of cast iron, and the cover, when thrown down, will not slam, the hinge bar being a spring, and raising the cover at a touch of the finger.

## IMPROVED BINDING FOR BLANK BOOKS

A binding especially adapted for record books is shown in the accompanying illustration, the binding permitting the convenient removal and replacing of ny of the leaves, for the making of entries by means f a typewriter instead of with pen and ink. A patent or the improvement has been issued to Edward M Wallen (Mrs. Mary B. Wallen, administratrix), Box 43, New Decatur, Ala. Fig. 1 illustrates, in the broken away portion near the back of the cover, the applica tion of the improvement. Embedded in the covers, near the point where they connect with the back, ar plates, the top ones resting upon flanges at the bottom of tapering thimbles, and a chain passed through a flexible tube extends from each of the thimbles to an opening in the bottom plate, where it terminates in a head. At the upper end of each chain is a screw ex ension received by a screw-threaded plug, shown in Fig. 4, the plugs fitting the tapering thimbles, and Fig. 3 shows a plug without a handle, to be substituted


WALLEN'S IMPROVED BOOKBINDING
for the other variety when the record is completed and the book is to be filed away. To remove a leaf, the plugs are removed, and the cover, with its thimbles opened back, when rods are screwed on the threaded extensions of the chains, as shown in Fig. 2, the leaves being then passed upward on the rods until the leaf to be removed is obtained, the rods being detached and the plugs restored after the leaves have been returned to their normal position in the book.

## IHE LUMIERE CINEMATOGRAPH CAMERA

The popularity with which the art of moving or chrono-photography has been received has led to the invention of numerous devices for taking the original pictures expeditiously and with as portable and compact apparatus as possible.
One of the most recent cameras of this kind is that invented by the Lumiere Brothers, of Paris, France, which works on a somewhat different plan than that generally noticed and, at the same time, is quite simple and certain in its operations, occupying but little space.
The peculiar novelty of this instrument is the manner by which the film is carried forward intermittently, no sprocket wheel being used.
Referring to the illustrations, the film-moving device (Figs. 1 and 3) will be observed to be nothing more than two prongs arranged like a fork, $D$, which


## Figs. 1, 2, 3.-Film moving mechanism.

are alternately pushed through or withdrawn from the perforated ribbon film by a rotating bar, C, having the ends bent in opposite directions, impinging on one or the other sides of a wedge-shaped cam, $D$, attached moving fork is also attached to an arm of a reciprocating yoke piece, A, actuated by an eccentric (see Fig. 1), so that the moment a section of the perforated film has been carried down by the fork, the fork is immediately withdrawn from the film by the rotating bar, C , impinging the cam, $D$. The fork is then carried upward by the arm, B, attached to A, clear of the film, the distance of the eccentric movement, until the opposite end of bar, C, strikes the cam, D, and forces the forks into the film perforations; the part, A, then moving downward in the opposite direction, quickly carries, also main actuating shaft is also arranged the shutter, $\mathbf{E}$ Fig. 2, which rotates in harmony with the film-moving mechanism. Fig. 2 shows a vertical section of the ma chine. $A$ is the film-operating part, $E$ the shutter on the main shaft, there being on the rear end of the latter a pinion operated by the larger cog wheel, which is worked by a handle. On the upper end of the box is the supply of the sensitized ribbon, which passes downward between guides before the lens opening. The bent ends of the cam operating bar will be clearly seen. Fig. 4 illustrates the exterior of the instrument, showing more especially the way the film is carried through the machine. The use of the appa ratus is shown in Fig. 5, where it will be observed supported on a tripod and its portable nature made manifest. The ingenious device for producing an intermittent movement without sprocket wheels or cogs is one of the features of the camera, while its lightness and facility of operation by simply turning a crank makes it adaptable for use in most any place. Parents with such a camera can preserve all the peculiar antics of their children or of pet animals and numerous other interesting incidents that are constantly occurring. The same camera can be converted into a projecting apparatus for throwing the moving pictures on the screen in regular sequence. The pictures taken with this apparatus are about an inch square. It should not be long before a hand camera based on the same idea should be in use, comparatively automatic, so that every time the tourist makes an exposure it will mean from forty to a hundred pictures at one release of the shutter trigger. The increased interest shown in this class of pictures certainly should stimulate the invention of various forms of portable chronophotographic cameras.


Fig. 5.-THE CINEMATOGRAPH CAMERA IN OPERATION.
road existed from Cairo to the desert, and yet when the sovereigns went to see the pyramids the road was built and planted with shady trees. It had all been accomplished in a few days.

Nothing is more interesting. than a talk with Brugsch Bey when the veteran of the memorable Ma riettedays is willing to entertain you of this strange period. He will tell you how Verdi was called upon by a Khedive's caprice, and "Arda" written in a few weeks to retrace the old days of Egypt. Nothing was spared to make a more vivid picture of the past. Mariette and Brugsch Bey himself were the stage painters, and the scenes were copied from the genuine records; while


Fig. 4.-DRIVING GEAR AND FILM SUPPORT.
Nubia had to supply ballet dancers and her black cohort. Then the Egypt of the Pharaohs was revived at the will of this modern ruler.
So we will soon have to go to the pyramids in a plain street car. In spite of the majesty of its souvenirs, the Memphis necropolis will become a general picnic ground. But now that it is going to be more accessi ble to visitors, it is to be hoped that strict rules will be enforced for the preservation of its monuments. Nothing is more destructive to antique remains than tourists in their uncontrollable desire to substitute the world-known names of Jones, Smith and Brown for the less euphonic ones of Cheops, Kephren and Mycherinus. It has been found difficult to keep the base of the pyramids free from debris accumulated by ages; by a judimids free from debris accumulated by ages; by a judi-
cious tolerance, privileges should be given to tourists cious tolerance, privileges should be given to tourists
to take it away as mementoes, and the task would be to take it a way as mem
accomplished speedily.

Freezing Point of Mercurial Thermometers.
Dr. J. A. Harker, in a paper recently read before the Royal Society on the determination of the freezing point of mercurial thermometers, stated that the method adopted is to cool distilled water in a suitable vessel to a temperature below 0 degree, to insert the ther to a temperature below 0 degree, to insert the ther-
mometer, and then bring about the freezing of the water by dropping in a crystal of ice. The thermometer then rises, and finally attains a steady temper ature, differing only very slightly from the true zero. The apparatus employed consists of two portions, the thermostat and the cooler. The former is a copper vessel, filled with either refined petroleum or a strong solution of common salt. The vessel communicates with the cooler, through which the liquid can be pumped by a rotary stirrer, and by this means it can be cooled and maintained for some time at about-2 degrees. The distilled water to be frozen is contained in a glass tube of about 300 c. c. capacity. This is first placed directly into the circulating liquid, and cooled quickly to -0.5 degree or -0.7 de quickly to - 5 degree or -0 de-
gree. It is then transferred to a cylinder lined with polished metal, placed in the center of the thermostat. The thermometer whose zero is to be taken is then quickly fixed in position, the bulb and a considerable length of the stem above the zero being immersed in the water. A crystal of ice is dropped in, and the temperature quickly rises to the freezing point.

## alvan gratam clark

In our last issue we gave a brief biographical sketch of Alvan Graham Clark, the famous telescope lens maker and astronomer; now, through the courtesy of the family, we are enabled to present an engraving of the late Mr. Clark, and also give further detals of his ife and work.
The sudden death of Alvan Graham Clark, the last member of the dynasty of lens makers, came as a shock to all those who are in any way interested in the progress of astronomical science. It is gratifying to note that, though Mr. Clark is the last of the family of expert opticians, the business will not be discontinued on account of his death. For the past twenty-five years, the Clarks have had for their chief assistant Mr. Carl Lundin, who has already achieved a personal reputation for skill and painstaking work. He and his sons will now carry on the manufacture of telescope lenses as before, in the interests of the family of Mr. Clark
Mr. Clark was descended from old pilgrim stock and was the younger of the two sons. He was born in Fal River, Mass., July 10, 1832. He received a good school education and, developing an interest in mechanical pursuits, fitted himself for a practical machinist. About this time his brother George and his father turned their attention to telescope making and, realizing the possibilities in this direction, Alvan joined the firm which has since become famous under the name of Alvan Clark \& Sons. The difficulties in the way of fostering a scientific enterprise are always great, but it is due to the persistence, painstaking and ingenuity of the Clarks, father and sons, that they obtained so great a success. Though no such feats of optical skill have ever been equaled elsewhere as the manufacture of the 36 and 40 inch telescopes of the Lick and Yerkes observatories, yet it was Mr. Clark's Yerkes observatories, yet it was Mr. Clark's a sill may, even his expectation, to produce a still more powerful instrument from the largest disks of glass that could be obtained. As it is, the production of the objective of the great telescope of the Yerkes Observatory will remain as Mr. Clark's greatest achievement
Valuable as were Mr. Clark's services to science as a great manufacturer of telescope lenses, he was also celebrated as an astronomer. He discovered fourteen double stars and he was a member of the expedition which went to Spain to observe the total eclipse in 1870 and to Wyoming eight years later. In 1862, he received the Lalande prize from the Academy of Sciences of France for his discovery of the companion star of Sirius. He was a fellow of the American Association for the Advancement of Science and an honorary member of several foreign societies.

A Volcano as a Weather Prophet.
Under the heading "Stromboli as a Weather Prophet," Gaea (Leipsic, September) publishes an interesting notice from which we learn that this volcano has been used from the earliest times, both by mariners and by those who live in its vicinity, as a means of predicting the weather. A recent exhaustive study of the subject, while it does not confirm quite all that has been claimed for the volcano in this line, amply justifies the confidence that has been placed in it. Probably other volcanoes of the same class would give equally trustworthy indications, and it may be that nature has thus been furnishing us with a means of local weather prediction that has been somewhat neglected. The Literary Digest trans lates below the article referred to :
"Among the Lipari Islands, between Sicily and Calabria, Stromboli is the best known on account o its active volcano. 921 meters [ 3,000 feet] high. Even in ancient times this served the sailors of the Tyrrhenian Sea as a weather sign. Pliny relates that the inhabitants of the island could tell from the smoke of the volcano what the direction of the wind would be, and Martianus Capella says that the king of the island was Æolus, who knew the changes of the wind from its flame and vapor. These tales are true in so far a the smoke column of the volcano, ascending, as it does, far into the upper air, can give indication of the ai currents that prevail there, before these have mad themselves felt on the ground. Later on, Strombol became still better known as a weather prophet, and Dolomieu, who in 1781 visited the Lipari Islands, tells us that in general this volcano is noticeably more active in winter than in summer, and also more activ on the approach of stormy weather than in a calm Spallanzani, who visited Stromboli in 1788, investi gated the weather indications that the inhabitants ha derived from the volume of smoke and the brightnes of the flame of the volcano, and found by actual obser vation in seven cases that these rules for the most par were not trustworthy. The well known expert in vul canology, Poulett Scrope, was led to believe in a con nection between the activity of Stromboli and the atmospheric pressure, because an alteration of this
pressure must alter the balance of the expansive forces in and under the crater. Judd also regards it as beyond doubt that in stormy weather, and especially in winter, the eruption of Stromboli is most violent, and he cites the testimony of the islanders in favor of this. The same opinion is held by Mercalli, who ascribes to meteorological conditions a preponderant influence on the activity of the volcano. Quite recently Alfred Berget, of Munich, has taken up the question anew, and in 1894 he made a long geological study of the Æolian Islands. In a paper in the Proceedings of the German Geological Society, he describes his own observations on the alleged connection between the changes of atmospheric pressure and the activity of Stromboli, from which it appears that such a relationship is unrecognizable. Moreover, he has compared all the eruptions of Stromboli since 1881 with the condition of the atmospheric pressure, and has found that there is no evidence for the hypothesis that the energy of the volcano increases with diminution of the pressure, nor can any lowering of activity be shown to follow upon a rise of the barometer. Finally, he also found that the list of eruptions given by Mercalli cannot safely be depended upon. He also carried out a theoretical investigation of the subject, that led him to the conclusion that no noteworthy influence on the activity of the crater can be ascribed to the pressure of the atmosphere, although it has been regarded by some as a natural barometer. But how about the popula some as a naturalbarometer. But how about the popular belief, which regards Stromboli as a weather prophet


## alvan graham clark

Dr. Bergert answers this question as follows: He notes that this belief has to do only with the smoke that issues from the volcano. It is, he says, water vapor which seems to envelop the summit of the volcano as a cloud. If moist masses of air blow over Stromboli he vapor that rises from the volcano will become nore clearly visible than when dry winds are blow ing in the upper regions of the air. In this way the volcano acts as a very sensitive hygroscope and at the same time as a weather vane also, and by the combination of its indications have for a long time been able to derive trustworth prognostications of the weather. 'When the air is moist,' says Dr. Bergert, 'if the cloud of vapor over the volcano's summit is thicker, the reflection from the ight that shines upward through the crater will also be more evident, which was probably what gave rise o the idea that the volcano is more active in stormy than in clear weather.' The question by what condi tions the eruption of the volcano is influenced is a present not to be answered with certainty. Berger believes that Mercalli was right when he regarded the arying activity of such a volcano as Stromboli to de pend chiefly on the stoppage of the lava channel and the subsequent clearing out of it. Bergert expresses the hope that an observatory may be established on he isle of Æolus for the special observation of its vol cano, so that the action of meteorological causes may e clearly separated from other influences on the vary ing activity of the volcano."
ranch of tory at Odessa is to be established as
branch of the observatory of Pulkowa

## The Basilicas of Rome.

Christianity was emerging from catacombs and hid ing places and ousting the heathen worship everywhere In the region " over the Tiber" they had been grudgngly allowed to worship in some building where now tands the basilica of Santa Maria in Trastevere. The edict of Constantine left them free to worship in public he temples were deserted in Rome, though heathen rites expired more slowly in the villages, and the ques tion at once arose, What buildings should they worship in? The temples were objectionable from their asso ciations; they were rejected. Not so, however, their naterials ; this must be borne in mind, as it exercised n immense influence upon the future designs of hurches. Columns and $r$ ases, but especially the former were freely had recourse to when building operations began. But at first they were well content to use the structures allotted to them by the Christian emperor These were the basilicas.
The word is derived from the Greek basilike, "royal," and in early times probably meant the place where the uler himself administered justice. In Rome they were used as law courts, though commercial business was ften transacted in them besides. There were many in the city, some on a scale of great magnificence, usually tuated near the different fora or market places, and named from their founders the Æmilian, the Porcian the Julian, after the first Cæsar, and the Ulpian, which is represented on a coin of Trajan. An approach a colonnaded court was sometimes provided,
and common with the practice of most ancient cities, they were rarely quite isolated The building was usually oblong in plan. On ntering, the visitor saw on either hand a line of columns dividing the structure from end to end into three sections, the center, called from its long, narrow shape the navis, or ship, the side alleys, much narrower, aisles. These ar he original "nave and aisles" of our modern churches. At the far end the wall was curved into a deep apse, a semicircular recess covered by a half dome or "shell" (concha) which it esembled; in its center, upon a narrow plat orm approached by steps, was the judge's seat Here he sat looking down the building and acing the entrance; on either side were hi assessors, their curving stone seats filling th est of the semicircle. Over the side aisles wer galleries. The roof of wood, and not as ye vaulted, rose very high over the central nave high enough for small round headed window unglazed) to clear the lean-to roofs which overed the galleries, thus acting as a clear story to light the building. It is probable that there were no other windows at first, bu hose who have seen how easily a structure is lighted in Italy will not wonder at this sometimes a single window-the others having been bricked up or partly obscured by curtain -will suffice to flood a church with light.
Greek and Roman buildings can scarcely be said to have had windows; they play no par in the designs of the public edifices, while private dwellings were built round courtyards. The original purpose of the apse is preserved in the Italian word tribuna, used for chambers and structures of this shape. Its raised steps were sometimes so high that rooms were buil underneath them, though for what uses is unknown. Under the entire pavement of the hall a heating chamber, with the usual Roman urnaces, was generally provided. Where the judge ad sat the bishop was now enthroned; his clerg ccupied the half circle of seats to his right and left. The galleries were appropriated to the women and in some cases there were separate seats for th unmarried, married, and widows. These halls, thu suddenly invested with extraordinary interest, wer not planned with any particular direction; they arose as circumstances demanded, and being turned into churches, the old doors were still used. It may be fo this reason, but the custom of "orientating," or turning churches to the east, is almost unknown in Italy. St Peter's, for instance, is entered from the east end, and ot, as with most of our churches, from the west. Th materials of the old temples were abundant on ever ide; the walls would be of little use, but columns and architraves were taken by scores. And an extraordinary use was made of them; for as the original basilica were superseded by new ones, "basilica" thus becoming synonymous with church," a conflict began between the traditions of the orders and the wants of the new worship.-Temple Bar

Mr. Lawrence Bruner, of the University of Ne baska, has sailed for the Argentine Republic to tudy the ravages of the locust, which have recently developed into a terrible pest, certain regions bein completely devastated by them. The Argentine government has granted $\$ 400,000$ for relief, and a syndi cate of business men have raised the funds to employ Mr. Bruner to investigate the subject from the ento mological side.

## Sorrespondence.

The New Supplement Reference Catalogue. To the Editor of the Scientific American :
Many thanks for the Supplement catalogue. It is indeed a valuable aid to quickly find the articles in the SUPPLEMENT. I have nearly all the numbers of Scientific American and Supplement and constantly entific American and Supplement and constantly
use them for reference. They have been of greatest value to me in the study of natural sciences.

Rev. Marcus Kiek. St. Francis Seraphicus Convent, Cincinnati, June 11, 1897.

Death of Father K neipp.
Father Sebastian Kneipp, the genial old priest whose water cure, or grass cure, made him famous, died at Woerishofen, Bavaria, on June 17, in the seventy-sixth year of his age. Father Kneipp was a unique figure in the history of the healing art. His fame came from his original method of treating diseased persons by means, chiefly, of cold water applied in a variety of ways. He practiced the cure for over a lifetime, although it came into general vogue only in the last five years. He was born in 1821, and after leaving school worked as a weaver until the age of twenty-seven, when he began to study medicine and theology, having long desired to become a priest. He was in ill health, and in a delirium of fever he rushed from his room and thrust his feet through the ice in a pond, and instead of becoming worse found he was much better for the shock, and so began systematic experiments along this line.
He was admitted to holy orders and went to the vilage of Woerishofen in Bavaria, where he earned the love of his neighbors and the mountain folk, whom he had cured of disease by the cold water treatment. His fame was for a long time local, but in time it spread all over the world, and people came to him for treatment in large numbers. The doctors looked askance at the spectacle of a priest making use of the methods only ascribed to a charlatan, but he really was no charlatan. At last notable persons began to come to him for treatment. Emperor Francis Joseph took a course of it on two occasions. The Archduke Joseph of Nustria also underwent the cure, and it was an amusing sight to see some of the notables of Europe walking barefoot in the dewy grass in frock coats and white cravats. This barefoot walking became the best known system introduced by Father Kneipp. His belief was that most illness was the result of the luxury of modern living, and his aim was to improve the circulation and tone up the system. He made use of local bathing and applications jogether with steam baths which were sometimes med icated with herbs. To stimulate and restore the circulation, he ordered the barefoot walking and cold douches. He always made it a point to see his patients himself, and he made no charges for his services. Contributions from relieved patients he used for parish work. For a long time there were not accommodations for the visitors in the village; but this has been remedied. In recognition of his work, the Pope bestowed on Father Kneipp an honorary office, which carried with it the title of Monsignor. In 1894 the Monsignor was called to Rome to treat the Pontiff, and it was announced after some time that, by his treatment, the Pope's health had been restored. Kneipp societies have been established in most countries of the world. The method of treatment has made some head way in the United States.

## The Work of the Postal Congress.

The fifth convention of the Universal Postal Con gress adjourned at Washington, June 15. It was decided to hold the next meeting at Rome, Italy, in February. 1903. The final sessions were devoted to the signing of the general treaty, which becomes operative on January 1, 1899. Each delegate signed these papers subject to the formal ratification of his government. The originals will be deposited in the archives of the state department and certified copies will be sent to all the governments comprising the Universal Posta Union. The following is an official resume of the results of the work of the Congress :

1. The principal treaty, which includes the entry of Corea into the Postal Union; the declaration of the Orange Free State (which failed to send a delegate to Washington) that it hoped soon to enter the union and the declaration of the Chinese empire (which was represented in the congress) that it will observe the regulations of the union as soon as the organization of its service permits.
2. The conditions in which the countries of the union will pay reciprocally the intermediary transit rates have been facilitated, and tariff diminished quite mate rially on a graduated scale for the ensuing six years.
3. Uniform colors have been projected for postag stamps.
4. Postal cards unpaid are subject to a double tax that is, four cents in the place of the former tax, which was ten cents, the same as for unpaid letters.
5. Circulars produced on a machine (typewritten) in
ter, areadmitted to the international mails at the same rates as printed circulars.
6. Samples of merchandise are admitted up to 350 6. Samp
grammes.
7. Objects of natural history, animals, dried plants, or preserved geological specimens are admitted as samples.
8. The question of the creation of a universal postage stamp brought up, and the proposition defeated, on account of the difficulties which would occur in putting into practice that important innovation, especially because of the diversity of currency standards.
9. Special arrangements concerning packages of de clared value, postal orders, books of identity, and subclared value, postal orders, books of torntity, and sub
scriptions to journals have been thoroughly revised scriptions to journals have been thoroughly revised
(This country is not actually concerned in these arrange (This country is not actually concerned in thesearrange-
ments, mostly affecting the states of the Continent of ments, m
Europe.)

## Recent Patent and Trade Mark Decisions.

## arner v. Stimson (Decision of Secretary of Interior

 78 O. G., 1901.Jurisdiction of the Secretary of the Interior over Judicial Acts of the Commissioner of Patents.-The Secretary of the Interior has no jurisdiction over acts of the Commissioner of Patents that are judicial in their nature. To construe and apply a rule of the Patent Office is a judicial act. At any rate, appeal will not lie to the Secretary of the Interior over an interlocutory order of the Commissioner of Patents.
Jenkins v. Jenkins (Decision of Secretary of Interior), 78 O. G., 1902.
Judicial Act of the Commissioner of Patents.-The decision as to whether an interference will be allowed to proceed or not is judicial in its nature, and likewise the question whether any one may be a proper party to an interference, and in either case appeal does not lie to the Secretary of the Interior.
Diamond Match Company v. Hanover Match Company
(U. S. C. C., Pa.), 78 Fed. Rep., 622.

Match Making Machine.-The Sisum patent, No. 281,408, for a machine for bundling match sticks, has been held valid as to claims 1 and 10 and to be entitled to the liberal application of the doctrine of equiva lency. The Donnely patent, No. 292,474, for a match making machine has been held valid as to claim 2.
Fowler v. Dodge (Commissioner's Decision), 78 O. G., 2045.

True Inventor of Linotype Machines.-Joseph C. Fowler has been held to have been the true inventor of the linotype machine set forth in his application filed October 1,
hilip T. Dodge
Sufficiency of Disclosure.-The drawing or other dis closure of an invention must be clear enough to enable one skilled in the art to construct a machine, and the specification may fail in this while showing an ade quate and complete conception of the invention.
Reduction to Practice.-Where the specification and drawings are sufficient to show an intellectual conception of an improvement. but not clear enough to enable those skilled in the art to make the machine, the filing of the application does not amount to constructive reduction to practice.
Arnold v. Tyler (Commissioner's Decision), 79 O. G. 154.
Reduc

Reduction to Practice.-Reduction to practice may be made with an experimental device, if it be by prac tical and successful operation and in such use as it would have to stand when manufactured. The use of a shoe last in trimming soles is not a reduction to practice of the same last for leveling soles, where the conditions are different and the strain is greater. Where the device was laid away for four years without use, there is a strong presumption that it was merely an unsuccessful experiment in the former alleged use, and the claim that the party was, during the four years, trying to devise means to make the device practical is inconsistent with the contention that such device was
in its first use a complete reduction to practice. The fact that the applicant made inquiries as to the patent ability of the device is immaterial to the question of reduction to practice or of due diligence therein. Delay for four years is conclusive evidence of lack of due dili gence in reducing a simple device to practice, at leas where the party had ample means.

## An Airship Takes Fire

A dispatch from Berlin, dated June 12, states that Herr Woelfert, a noted aeronaut, and his assistant Knabe, made an experimental ascent in a steerable irship from the Tempelhof field. When the balloon which had been filled at the military ballooning es tablishment, had reached a considerable height, esti mates of which vary from 1,700 to 3,000 feet, a loud ex plosion occurred, and the next moment the balloon was seen to be ablaze. The car, which was also on
fire, detached itself from the burning silk and fell with fearful rapidity to the ground. Both of the occupants were found to be dead. Their bodies were
horribly burned. It appears that the benzine used in the steering motor exploded, causing the disaster.

The Ameriean Academy of Medicine held its twentysecond annual meeting on May 29 and 31, at Philadelphia. It was largely attended.
It is said that some of the heirs-at-law of the late Al fred Nobel are contesting his will, by which he be queathed his property for the advancement of sciencs. Dr. Charles W. Dabney has been appointed special agent in charge of the scientific and statistical investigation of the United States Department of Agricul ture.
The Carlsberg fund for scientific purposes has offered about $\$ 40,000$ to the Danish scientific expedition to the east coast of Greenland, for the purpose of making a chart of the coast northward to Angmagsalik.

At a recent meeting of the Academie des Sciences, in Paris, M. Henri Moissan communicated the results of his experiments with Prof. Dewar in the liquefaction of fluorine gas. We have already referred to this interesting experiment. Though solid fluorine has not yet been obtained, M. Moissan is sanguine that this astonishing result will also be secured.
An interesting discovery from a geological point of view was recently made by an explorer in the mountains of Witzies Hoek, Natal, says Le Génie Civil. On the summit of an extinct volcano, on the edge of a lake that occupies the crater, soundings revealed a layer of sand inclosing small diamonds. It would be interesting to know whether these diamonds were there accidentally, that is, as the result of washing operations carried on by the natives, or whether this discovery corresponds to an actual mine of diamonds, for the hills of Witzies Hoek are not situated in regions known to be diamond bearing. On this last hypothesis, the presence of precious stones in the crater of a volcano would doubtless throw some light on the formation of the gems in nature.
Mr. J. C. Merryweather, the well known manufacti rer of fire apparatus in London, makes a most usefu suggestion on the subject of the protection of churches from fire. After referring to the dangers of fire in such buildings from defects in the heating and lighting apparatus, he proposes that each church tower should be fitted with a tank or tanks, kept full of water by means of a pump and hose or fixed pipe, the pump to take supply from a well or other available source. From the tanks he suggests a pipe being carried into the church, with hydrants and hose in convenient posi tions. The water tanks would then enable powerfu jets to be brought to bear immediately an outbreak of fire was discovered. The cost of the arrangement would be small, and doubtless the destruction of many sacred buildings by fire would be prevented. Canter bury Cathedral has been saved three times by its own fire apparatus, and the recent fire at St. George's, Hanover Square, proves that even in London there is considerable risk of fire in places of worship.
In his second lecture on "Liquid Air as an Agent of Research," delivered at the Royal Institution, says The Engineer, Professor Dewar continued his remarks on the critical constants of gases, and brought forward some interesting speculations founded on this extension of certain laws, known by experiment to hold good a accessible temperatures, to bodies which one coul. never hope to be able to examine in the liquid state With regard to the theory that carbon is a very important constituent of the sun, he pointed out that the density of the latter was $1 \cdot 4$. Supposing it to consist of carbon at the critical temperature, its density when cooled to liquefaction would become $4 \cdot 2$, according to known laws, and if it were cooled to the temperature of this earth, its density would increase by some thing like one-quarter. Therefore, the density of the naterials of the earth-which was 5.5 -did not appea to be far removed from the density of the sun at the same temperature. The lecturer, for the first time in public, froze a specimen of argon, supplied by Lord Rayleigh, to the solid state by means of liquid air at a temperature more than 200 degrees below zero.
Working in the physical laboratory of the Massachusetts Institute of Technology, Mr. R. W. Wood has succeeded in producing diffraction phenomena with Roentgen rays, says Nature. The source of the rays was an arc-like discharge between two very smal beads of platinum in a high vacuum. The discharge bulb was only about an inch in diameter, while the radiation-which came from an area about the size of a pin head--was strong enough to show the bone in the forearm. The "arc" appeared to be a new form of cathode discharge, and could only be pro duced under peculiar conditions. Mr. Wood used a tube with a platinum slit 0.1 mm . wide, mounted within the bulb at a distance of 2 mm . from the radiating bead. The second slit of variable width was placed at a distance of 10 cm . from the first, and the photographic plate at distances varying from 10 to 30 cm . from this. The images of the slit on the plate howed a distinct dark line on each edge, which could only be explained on the supposition that inter ference occurred. The plate was at too great a distanc rom the slit for such an effect to be produced by eflection of the rays from the edges. Images of fine wires showed similar phenomena.

THIRD RAIL ELECTRICAL EQUIPMENT OF THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD. (Continued from Scientific American of June $12,1897$.
In our previous notice of the electrical equipment of a portion of the lines of the New York, New Haven and Hartford Railroad we stated that the power house at Berlin was a plain rectangular structure 106 feet in width by 117 feet long, the sides and one end being of brick, the other end being temporarily boarded up until the building shall be extended and completed. The building is divided longitudinally by a brick partition wall; the front portion, or that facing the tracks, is two stories in height, the engines and dynamos being installed in the upper story and the heaters and various accessories in the basement. The rear half constitutes the boiler room. Interior views of these rooms will be found on the front page of this issue.
At present the engine room contains a 1,200 horse power engine of the cross compound type, with a 28 inch by 48 inch high pressure cylinder and a 48 inch by 48 inch low pressure cylinder. The flywheel is 18 feet in diameter and weighs over 52 tons. The engine dynamo shaft is of hollow steel, and the engine is direct connected to a General Electric Company's standard 10 pole, 850 kilowatt generator of the ironclad type.
The switchboard shown in the accompanying illustration is set in a bay built out on the front of the building. It is of the standard panel type of the General Electric Company and contains seven panels, of which three only are at present equipped. Two of these are generating panels and the third is a totalizing panel. Upon the former are automatic circuit breakers of extra large size, with magnetic blowout and the usual generator panel equipment ; the totalizing panel carries a Form G Thompson 5,000 ampere recording wattmeter and an 8,000 ampere station ammeter. Four cables, each of 850,000 circular mils cross section, run from the switchboard to the third rail.
The boiler room contains ten horizontal tubular boilers, which type has been selected on account of its "simplicity, high economy, and general reliability." In setting the boilers, care has been taken to provide for absolutely free expansion in all directions, and especially in a direction transverse to the axis of the boilers. It will be seen from the illustration that the boilers are suspended from two pairs of I beams, which rest upon the brick partition walls, the suspension rods being linked to straps which are riveted to the shell of the boiler. The great height ( 48 inches) from the fire bars to the boiler is a noticeable feature, and it was adopted in order to secure a more thorough com bustion and a slower passage of the gases to the uptake. It is claimed that with judicious firing the uptake temperature has been kept considerably below the normal for this type of boiler. The grates are designed for burning the half burned coal known as "sparks," which is recovered from the fire boxes of the locomotives of the New Haven road. As there are several hundred tons of this material produced every month, it can be understood that it is an extremely cheap fuel as delivered in the bins at the power house. The pipes which lead down through the partition walls and below the grate are for introducing a mixture of steam and air to supply the necessary oxygen for combustion. Each pipe is slightly flaring at the top, and contains an annular steam pipe perforated on its under side. The gases pass from the boiler tubes to a rectangular flue, which extends the full length of the nest of boilers, and delivers into a cross flue $51 / 2$ feet wide by 8 feet deep, which leads to a chim ney 125 feet in height on the outside of the building. The "sparks" is deliv-
nected with the header by a heavy seamless copper 9 inch pipe bent to a radius of $81 / 2$ feet. The throttle valves are placed at the junction of these pipes with the header, the valves being all of the balanced type. Steam is led to the engine by 12 inch wrought iron pipes with bends of large radius. The piping of the accessory steam plant is so arranged that the engines may be run as condensing or non-condensing. Each side of the engine can be run independently and the feed may or may not be heated, at the option of the engineer.

In the illustration showing the various car couplings will be noticed the electri cal car coupling or connector-box. In the earlier experiments considerable trouble was experienced at the exposed point where the wires entered the motors, and the connector box was designed to over come the difficulty. The connection consists of a hollow brass tube, split a the outer end to give it a tight grip of the motor wire, and incased in a wooden plug. There are two of these and they enter a connector box located beneath the front end of the platform, as shown in the engraving, the box being closed by a lid when it is not in use
The closed cars are each provided with sixteen electrical heaters, which are placed beneath the seats as shown in the sketch. The degree of current and therefore the temperature is regulated by means of an electrical switch of special construction. There are four graduations on the dial : full, half, low, and off. 'The dial, which is movable, has the brushes attached to its inner face, and these move upon a series of contacts on the fixed plate. In order to reduce the spark on openthe fixed plate. In order to reduce the spark on open-
ing or closing the switch, the switch lever is formed separately from the knife, the former being hinged to the latter near it junction with the switchboard. Nor mally the knife is hold against the lever by the tension of a plate spring; but when the lever is pulled open the two are separated, the knife snapping suddenly against the lever as it leaves the contacts and reduc ing the duration of the spark.
The heaters in each coach are connected in series with each other and form a complete circuit ex tending down on one side of the car and up on the other, in which all of the six


SWITCHBOARD, BERLIN POWER STATION.
that satisfactory results may be obtained by exercising care and good judginent in the design and erection of a single system. Accordingly, every provision has been made for free movement of the piping under expansion and contraction. In the first place, a 20 inch wrought iron header runs the entire length of the boiler room, at a height of eight feet above the boilers. It has a free longitudinal movement upon rollers, which are carried upon brackets attached to the cen ral partition wall of the building. Each boiler is con
teen heaters are included. This circuit, known a the series wire, has no connection with the heat regulating switch, neither is the positive (trolley) no the negative (ground) side of the current supply permanently connected to any portion of this cir cuit. A variable ground and trolley connection is car ried by the regulating switch and can be applied by means of tap wires to one or more points of the serie wire or circuit, according to the amount of heat required As the heat generated is directly proportionate to th amount of current flowing through the wires of each heater, and as thi flow of current is governed by the combined resistance of the heater through which the current must flow it is but necessary to vary the numbe of heaters between a point where the current enters and where it leaves agai in order to regulate the temperatur to any desired degree.

## India's Severe Earthquake

Dispatches from Calcutta, dated June 14, state the gravity of the earthquake shocks of June 12. An extensive area was affected and much misery was caused among many of the poorer Europeans and natives The shocks were felt over a large territory and traffic on the Eastern Bengal Railroad was interrupted Bridges have been damaged and a train was overturned on the Assam Bengal line. The heat prevailing is the highest on record, 126 degrees in the shade having been registered at the Jacobabad, on the frontier Belochistan.

## THE MECFIANICAL BASEBALL PITCHER．

We present some engravings of Prof．C．H．Hinton＇s mechanical vaseball pitcher．This new gunpowder gun for pitching a baseball was tried at the Princeton ball field on June 8，9，and 10 into position and expert players were allowed to bat the ball．The resul of the test was very suc－
cessful，the ball being discharged by electricity． The tension was varied and drop and curve balls were discharged by the gun with ease．Prof Hinton has provided us with the following descrip－ tion of his interesting me－ chanical pitcher．He says ：
The problem of pro－ ducing by inanimate me－ chanism the equivalent of a ball pitched by the hu－ man hand divides itself in－ to three parts．
First，the projection of a ball so that its velocity varies within narrow lim－ its，and its direction is ac－ curate．
Secondly，the imparting to a ball so delivered a spin or rotation about an axis which does not coincide with the direction of flight， but lies at right angles to it．
Thirdly，the providing an equivalent or substitute for the motion of the pitcher＇s arm preparatory to the delivery of the ball．The most natural plan to pursue in seeking to reproduce a pitched ball by inanimate mechanical means is to construct a catapult．

An instrument of this kind capable of projecting a fairly accurate straight ball is not difficult to make，but when it comes to combining a rotator with the project－ ing apparatus，the problem assumes a different aspect． And even if a solution were arrived at，the construction would，for the special purpose for which it is designed， be impracticable，on account of its cumbrous nature．

The moving parts and guides must，in their weight and friction，far exceed the inertia of the ball，and a source of energy vastly disproportioned to the effect produced would be needed．
Such，at least，were the considerations which led me to abandon the construction of a catapult pitcher and to adopt the expansive force of gunpowder acting behind the ball in a tube，as the source of projectile force．
With the simple and satisfactory means，however，of producing rotation described below，a catapult form of pitcher does not seem to be at all impossible．

Adopting powder and a tube，it is by no means the case that a true and accu－ rate ball can be produced without further thought．
If the powder is ignited in a small chamber behind the ball，the most varied effects follow．The ball sometimes fails to travel its course，sometimes flies with prodigious velocity．When a short barrel is used，the results are better；but the most absolute accuracy in loading and uniformity in wadding are requisite．The whole condition，however changes as soon as a long tube of small caliber is tra versed by the exploding powder before it emerges into the large barrel in which the ball is held．
With such an arrange－ ment，the difficulty of sending one ball after another with a uniform velocity disappears．In the experimental model and in the light gun，illus and in the light gun，illus 38
100
100
inch internal diameter and of a length of about 4 feet is used．The results would probably be still better and more uniform with a tube of 30 caliber， the length being the same．
It is certain that a tube of 44 caliber，even though a little longer，is compara－ tively extremoly unrelia ble．＇⿴⿱冂一⿰丨丨丁口灬 tube may be straight or coiled．If coil－ ed，a slightly heavier charge is needed．The rea－
gas in each case produced．With such a tube，also，
the deli very of the expanding gases on the ball is effected
sons of the effectiveness of the long tube appear to be two：In a long tube，the complete combustion of the powder is secured and the maximum amount of


THE BASEBALL CANNON． body is hit a violent blow when confined in a tube，its lateral expansion causes it to jam，and when released from its momentary arrestation the gases heaped up behind it urge it on with great velocity．
A straight ball of fairly uniform velocity being thus


CROSS SECTION OF THE BASEBALL GUN．
obtained，the rotation round an axis perpendicular to the line of flight is obtained by prolonging the inner surface of the tube in two separate lines widely distant from each other，so that when the ball leaves the bar－ rel it is touched in two spots and retarded by the pro－
longation of the tube．This is effected by means of


GUN FOR DELIVERING A CURVED BALL AS USED ON THE PRINCETON BALL GROUNDS
＂fingers，＂thin plates of metal，which，fastened to a
ring movable round the muzzle of the gun，project
over the thickness of the barrel，so that their edges are in a line with the interior of the tube．
These fingers are curved and covered with rubber． The ball，on leaving the barrel，owing to their curv ature presses itself against them more and more Owing to the nature of the substance with which they are covered，the bal slips very little．It tends to roll，and roll，not on a ull circumference，but on two small circles near th poles．It thus obtains a velocity of spin preate han that which it would than if it traversould have if it traversed it course rolling against a surface instead of flying through the air．This spin gives it the curved path．
The cap which carrie the fingers can be turned round on the muzzle of the gun so that any required curve can be obtained．
The ball curves in that direction toward which the without shock．A baseball is elastic．If an elastic｜front is moving．Hence，if，looking along the gun，the

SuAMN front is moving．Hence，if，looking along the gun，the
fingers are put on the right hand side，the curve wil be an in curve，that is，to ward the observer＇s right hand With fingers seven inches long，slightly curved，and covered with one－eighth inch rubber，the gun will send balls varying from right to left of a mark by only a few inches，and making a curve of nine or ten inches deviation from a straight line．
With fingers more strongly curved，the deviation of the ball is greater，but the accuracy is impaired．Pro－ bably with longer fingers of slight curvature a greater deviation could be obtained without loss of accuracy．
In order to obviate any dangerous velocities，and thus make the gun perfectly safe，the breech，which closes the barrel immediately behind the tuhe for the delivery of the expanding gases，is made movable．It fits easily in the barrel，and the necessary obstruction to the powder gas is secured by means of packing． The breech is pressed forward by a spring coiled in the part of the barrel behind it．The spring is so regulated as to press on the movable breech with the same force that the powder does when driving the ball at such a rate as to traverse 60 feet in six－tenths of a second，that being the speed at which a ball of fair velocity is pitched．If，for any cause，the pressure in the barrel becomes greater than that necessary to pro duce this velocity，the breech is pressed back and an aperture in the side of the gun is thereby made ac cessible to the gases，and thus the pressure on the ball is relieved．
Without the movable breech，a ball which fits tightly in the barrel is a possible source of danger， on account of the high ve locity with which it is pro pelled．With it a tightly fitting ball is driven out more slowly than one which fits properly．

The breech is kept in place against the spring by a rod passing through an opening at the end of the gun，and secured by a nut．

Variation of speed with－ out a change of cartridge can be obtained by shift－ ing the position of the breech．If it is drawn back so as to leave a space behind the ball，a ＂windage＂is provided， which moderates the speed． There are difficulties， however，of a psychologic nature in the way of the successful use of the gun as hitherto described．The ball comes too suddenly； there is nothing to com－ pensate for the motion of the pitcher＇s arm．As a substitute，signals of vari－ ous kinds have been tried， but an effective plan，and the one at present adopt－ ed，is to dispense with the necessity of signals
altogether. By means of a very simple electrical arrangement the batter fires the gun himself. When throwing his foot forward to take the position for striking he presses on a plate, breaks an electric circuit, and so releases a spring which pulls the trigger. He thus, after a few trials, is able to know the exact instant at which the ball willappear at the mouth of the gun, catches it with his eye at the moment oì its emergence, and finds no difficulty in following its course. The problem of delivery is thus altogether eliminated and a practice ball is sent which can be judged entirely by its course in the air. For general use a trigger must be devised which gives a short but definite interval between the pull on the catch and the explosion of the cartridge. With such a trigger the batter can accustom himself to the delivery of the gun when fired by another than himself as easily as to the delivery of a pitcher.
The fingers form the essential feature of the gun, and they, it may be observed, can be used with any form of projector. A catapult is in the process of construction in which a rigid arm moved by springs is suddenly arrested. The arm carries the ball in a holder, from which project two curved rods. At the moment of arrestation the rods are momentarily stationary, the ball then, rolling along them exactly as in the case of the gun, acquires a spinning motion.
But, on account of portability, ease of manipulation, and handiness, the gun appears to be the preferable form, and it remains to be seen whether it will supply the need which exists in baseball-the need of a generous supply of curved balls for practice.

The Passing of the Narrow Gage in America. The passing of the narrow gage is again evidenced by the transformation of the track of an Iowa road from a gage of three feet to that of standard, which has just been accomplished without interrupting traffic an entire week day, says the International Ticket Agent. The road referred to, the Des Moines and
Kansas City, having 112 miles of narrow gage track, was operated in connection with a standard gage road, was operated in connection with a standard gage road,
the Keokuk and Western, 148 miles long, under the the Keokuk and Western, 148 miles long, under the
same ownership and management, making diversity of same ownership and management, making diversity of
gage particularly undesirable. By widening 72 miles gage particularly undesirable. By widening 72 miles
a continuous line 220 miles long is established between two important cities, and the immediate result will doubtless be increased traffic and reduced expenses from abolishing transfer of freight and passengers.

Forty miles of the road are left unchanged for the present, but will inevitably join the majority ere long. Besides this, the only narrow gage track remaining in Iowa is that of the Burlington and Western and Burlington and Northwestern roads, aggregating 128 miles. These roads, which are conjointly operated, independently of the C., B. and Q. system to which they belong, are so situated that they are giving pretty satisfactory results, although their ultimate change to standard gage may be considered certain.

## New Facts about Fishes.

Prof. A. E. Verrill, of Yale, has recently received new details concerning the great octopus which was found some time ago on the shore near St. Augustine, Fla. The professor classifies it as a species distinct from all known forms and proposes as a name for it Octopus giganteus. The part washed ashore was of at least six tons weight, which was about half its weight when living. The true length of the body is about 21 feet with a maximum width of about 7 feet and a diameter of at least 5 feet when living. Prof. Verrill thinks that two posterior stumps, looking like
arms, may be the remains of lateral fins. Some of the arms, may be the remains of lateral fins. Some of the
arms were probably about 73 feet long. The dimensions of the Florida octopus are decidedly larger than those of any of the Newfoundland specimens which Prof. Verrill brought to public attention years ago. Prof. Verrill adds that the species is probably one of the kind upon which the sperm whale feeds regularly on our Southern coasts, and that the specimen found may have had suckers as large as a dinner plate, corresponding to the size of suckers once described to him by a trustworthy whaling captain.
In a number of the American Journal of Science, Prof. Verrill describes some singular nocturnal changes in the colors of fishes and their curious habits when sleeping at night. His observations were made between midnight and twoo'clock A. M.. the gas jets near his aquaria being turned as low as possible. Most fish, the professor says, sleep very lightly and are roused by almost imperceptible vibrations of air or water. Flounders thus seen sleeping at night showed their dark markings much more strongly than by day, and the same was true in greater or less degree of the markings of certain minnows, king fish, the black sea bass and trout, the latter becoming much darker by night than
by day. This change is of a protective character. Describing other changes, Prof. Verrill says

Other fishes, however, show much more remarkable changes. Among these the scup or porgy is one of the best examples. This fish, when active in the daytime, usually has a bright silvery color with iridescent tints. But at night, when asleep, it has a dull bronzy ground color and the body is crossed by about six transverse back bands. When one of these fishes with this coloration was awakened by suddenly turning up the gas, it immediately assumed the bright silvery colors belonging to its daytime dress. This experiment was repeated many times on different individuals with the same result. As this fish naturally rests among eel grass and seaweeds, the protective character of its nocturnal olors is obvious.
A common file fish was observed that presents a very decided change in color pattern. This species in the daytime is mottled with brown and dark olive green and the fins and tail are a little darker than the body, but when asleep at night its body becomes pallid gray or nearly white, while the fins and tail become decidedly black. These colors are decilledly protective at night or in a feeble light among rocks and weeds, where it lives. This and other species of file fishes when sleeping would usually rest on the bottom with the back leaning against the glass of the aquarium or against a tone at a considerable angle.
The common tautog or black fish has the curious habit of resting upon one side, half buried among gravel, or partly under stones, and is often curved in strange positions. It is easy to imagine that the flounders originated from some symmetrical ancestral form that acquired, like the tautog, the habit of resting upon one side, at first only when sleeping, but afterward continually, owing to the greater protection that this habit and its imitative coloration afforded. The one-sided coloration and the changes in the posi-
tion of the eyes, etc., would gradually follow in accordance with well known laws of evolution.
The common squid was observed sleeping on several occasions. At such times it rests in an inclined position on the tip of its tail and on the basal parts of the arms, which are bunched together and extended forward, so that the head and anterior part of the body are raised from the bottom, so as to give room for breathing. The siphon tube is then turned to one side. Under these circumstances the color is darker and the spots more distinct than when it is active, owing to the expansion of the brown and purple chromatophores.

## RECENTLY PATENTED INVENTIONS. Engineering.

Steam Turbine.-Louis Bollmann, vienna, Austria-Hungary. This invention, also patented
in the principal European countries, is for turbines in the principal European countries, is for turbines
worked by steam or gas, and provides for reducing the worked by steam or gas, and provides for reducing the
speed at which such motors have heretofore been rotated, speed at which such motors have heretofore been rotated,
and expanding the stcam or gas usefully to a high degree. and expanding the stam or gas usefully to a high degree
It comprises a bucket wheel with guides at the entrance and exhaust sides, and central platee adapted to receiv steam at high pressure, while plates surrounding the first named plates have mixing chambers for receiving steam from the first named plates and openings for the admis. sinu of air. The ecentral plates draw or throttle the high pressure steam and form it into a fat or conical jet to be mixed with a proportional large quantity of air or gas of bine taving more than one circle of buckets and guide wilh their plates.
Locomotive Engine. - Charles H. Booth, New York City. A large tender, having driving wheels and driving engines recciving steam from the main engine, is provided by this invention, the driving uns without stopping for fuel and water. On the for ward truck are a high and a low pressure cylinder, the atter exhausting into the smoke stack, and connected to cylinder on the truck of the tender, the exhaust here being into the water tank of the tender, which has drive wheels arranged under its overhanging sides.

## Ballway Appliances.

Switch Operating Drvice.-Eduard von Haken, Charlottenburg, Germany. Pivoted cen trally in the bed of the railway, according to this inven-
tion, is a three-armed lever, one of the arms being adapted to engage a switch point, and the other two arms, which extend rearwardly from the switch, having at their end each a cam lying within the flange grooves of the rails. A vertically movable rod at each side of the car platform is held normally raised by a spring, but to move the switch point one of the rods is depressed to run through the ange groove of the rail and strike the cam. When one cam is within the rail groove
cide its groove, and vice versa.

Bicycles, Etc.
Pneumatic Tire.-John Carlyle Raywond, New York. A tire made of a series of interlocking raiber sections, according to this invention, is contained
within a casing of canvas or other suitable material, the within a casing of canvas or other suitable material. the
casiug being slotted at the inside, and its sides fastened casiug being slotted at the inside, and its sides fastened
to a rim in which are door closed openings giving access to each section, and permitting of conveniently removing
any one of the sections through its door. Set screws fasten the overlapping ends of adjacent doors. and should one section become punctured, it may be conveniently
removed and a new one inserted without deflating the removed and a new one inserted without deflating the
remaining sections or disturbing their positions on the

Pneumatic Handle. - Seward M. Gunsaul, Omaha, Neb. To take the place of the ordinary rigid, inelastic bicycle handle, this inventor has de
vised a handle with elastic body or casing secured to ron stem with a bore at its outer end in which is fitted an air inlet and outlet valve. Provision is made for the admission and escape of air and easy regulation of the degree of distention and firmness of the body by the ame valve attachment, which is perfectly protected in the bore of the stem, withont unsightly projection. The ferred fabric.
Bicycle Alarm.-John L. Leavitt Albuquerque, and Emil Bibo, Bernalillo, New Mexico the inside of one of the members of the front fork, the gong having a tubular hub in which elides a plunger, the forcing of which outward brings the outer end of a tongue of novel form in contact with projections or lips
on the spokes of the wheel, causing the gong to sound on the spokes of the wheel, causing the gong to sound,
while, if the tongue be forced still farther out, the hamwhile, if the tongue be forced still farther out, the ham
mer is free f:r-- ve gong and the alarm makes only a mer is free f:- we gong and the alarm wakes may be
buzzing, whistling or rattling sound. The alarm mater ongue are forced outward by a lever having a link connection with a lever fulcrumed on the handle bar.
Bicicle Gear.-Joseph Wheatley, Memphis, Tenn. According to this improvement, sprocket wheel on the rear brace bar, under the seat, is
otated by a chain whose ends are connected to ped levers whose rear ends swing on the axle of the rear wheel, the levers being connected near their forward ends by a strap extending around a roller on a depending
hanger. The sprocket wheel is a bevel gear meshing hanger. The sprocket wheel is a bevel gear meshing
with two bevel gears loosely mounted on a shaft at right angles, rotating in bearings on the rear fork, and rigidly mounted on this shaft, at the outer side of each bevel rigidly mounted on the shaft a sprocket wheel from which a sprocket chain extends to the sprocket wheel on the rear wheel axle. This gear is designed to facilitate
attaining a high speed and give a notable increase of power.

## Mining, Etc.

Safety Grip for Mining Cages. William H. Beakey, Walkerville. Montana. An appli ance by which a cage may be easily and safely stopped at
any time or place, in case of accident, is provided by this invention. In the shaft are vertica' guides and locking mechanism to engage them, the mechanism being connected with a lever arm normally engaged by a pivoted
crab, there being a lever and connecting rod to operate crab, there being a lever and connecting rod to operate
the arm and a catch to support the lever. By depressing a hand lever, a crab is raised to release the lever arm, which rotates gears to throw toothed cams into locking
engagement with the fixed vertical guides on the sides of the shaft.

Wrencte--Henry A. Snith. Elgin, Ill.
strong and inexpensive to manufacture, and capable of use particularly adapted for holding round objects. The ad justable jaw is closed by a nut and screw, entirely disconnected from the jaw, and opened by a spring when released from the tension of the screw, the latter serving in great measure as a brace for the movable jaw, enabling he wrencli to be used on very heary objects within the but little space, and is designed to be especially conve nient and handy for a wide variety of uses.
Bar and Shafting Turning Ma Hine.-Jacob Fitz, Hanover, Pa. In this machine th put on the ordinary lathe carriage. The tubular stem has a face plate on which tools are held to be movable in and out, a tool block for each tool and the blocks being engaged by an adjusting band, a beveled surface being provided whereby the band may force the blocks inward and so adjust the tools correspondingly. Carriers for clamping the shaft, and the carriers may be engaged with or feed from the feed screw.
Roof Framing Tool. - John Parkhill, Rochester, Minn. This invention relates to a for
merly patented roof-framing tool of the same inventor and provides a tool principally designed for automatically indicating and marking the proper side bevel of a jack rafter of any pitch. It has a member with a straight
marking edge in the plane of a bearing, and a finger pivmarking edge in the plane of a bearing, and a finger piv-
oted thereto about an axis arranged transversely of the marking edge, to swing in line with the marking edge and at an angle to the plane of the bearing.

## Agricultural.

Cultivator.-- - -albot Andrews, Monmouth, Ill. This invention is for an improvement in he cultivradide row cultivators for corn and cotton, of corn at once and being shiftable act on two rows without necessitating any change in the direction of the team. The draught attachment has a three-horse evener by which the draught of the middle horse equals or baltivating devices, each set being composed of two gangs of rotary disks, a vertical arch which rigidly connects them, and two pivoted draught bars attached to the
gangs and arch. The bars may be adjusted difer gangs and arch. The bars may be adjusted different
distances apart, thus contracting or widening distances apart, thus contracting or widening the arches, of disks.
Milk Aerator. - John Littlejohn, Aurora, Ill. To eliminate from fresh milk the animal gases, odors and heat, rendering the milk more pure and
palatable and enabling it to be kept a longer tine with out becoming rancid or sour, this inventor has devised a novel straining and spraying device to accomplish the aeration in one operation as the milk is transferred to the cans in which it is to be shipped or stored. The milk is passed through a strainer into a receiver, a bot-
tom flange of which has upwardly opening boles to tom flange of which has upwardly opening holes to
spray the milk up against the walls of a surrounding


#### Abstract

vessel, from which it falls in drops or a thin shect, to be again divided by perforations in the bottom of a pan be low. From a still lower pan the milk is conducte through a cooler to the storage or shipping cans. The pa.ts are all detachably connected, to facilitate packing and shipping. Capturing and Destroying Insects. -Joseph Strouhal, Beeville, Texas. Two patents have been granted this inventor for means for destroying in. been granted this inventor for means for destroying in- sects destructive to plante and vegetables, more particusects destructive to plante and vegctables, more particurun over a row of cotton plants and dislodge the insects, causing them to fall into pans where they will be killed by poison, the cotton removed at the same time being received upon screens and held out of contact with the poison. A wheel-supported frame on which is a driver's seat carries another movable frame, supporting pendent over the field, the plants project upward. According to one of the patents, the plants are simply struck by arms to dislodge the insects, while, according to the other patent, they are brushed by revolving brushes, the latter being adjusted higher or lower according to the growth of the plants, but in both cases the insects are dislodged and fall through the screens which support the cotton into the poison receptacles. The most efcarbolic acid.


## Miscellaneous.

Copying Camera Stand. - Owen Linley, London, England. 'To facilitate the production ngs, this inventor has devised a camera in which gear ing connects the camera front with the sliding copying
board, to shift the latter in its own plane in correlation with the focusing motion, so as to maintain constant during the focusing the predetermined position of the picture on the focusing screen, and enable the camera tnuously viewing the picture on the screen. Links connect the slide rest with a hand lever at the back of the camera. and a micrometer screw stop limits the rearward movement of the screen carrier. There is also a me-
chanism for adjust:ng the ruled screen within the chanism for adjust:ng th
camera in front of the plate
Automatic Fluid Governor. George W. Browne, Brooklyn, N. Y. A governor more especially designed for use on gas supply pipes has been devised by this inventor. It comprises a casing with
longitudinal hore, at one end of which is a bell-shaped mouth engaged by a valve, while a chamber at the other end is connected with a supply, the chamber having a movable and perforated bottom for increaaing or diminishing its capacity. The ball valve in che bell-shaped
mouth of the bore regulates the amount of gas delivered mouth of the bore regulates the amount of gas delivered
automatically to the desired quantity, irrespective of the automatically to the desired
pressure in the gas mains.
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water
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When cool add sulphuric acid in small quantities until blue litmus paper turns slightly red, then add a few red litmus paper turns blue. Then add to the solution 154 grains of red crude gum catechu. Allow it to dissolve, with occasional stirring. The solution will keep indefinitely. After the print has been washed out in the usual way, immerse it in the above bath a minute or so onger than it appears when the desired tone is reached. An olive brown or a blackish brown is the result.

## NEW BOOKS, ETC.

Electric Power Transmission
Practical Treatise for Practical Men. By Louis Bell. New York: The W. J. Johrston Cowpany. 1897. Pp.
491. Price $\$ 2.50$.

The familiar power house of the Niagara Falls generating plant gives the subject for the frontispiece of this ex-
haustive book. It really seems as if an adequate treat. haustive book. It realy seeme as if an adequate treat.
ment was at last given to an all-important subject. The design of the author has been to avoid the foliowing up of the abstract mathematics of the subject, simply introducing such conditions as are quite essential to a proper treatment of the subject. He devotes his energies on the other hand to putting into tangible shape the most recent results in this branch of electrical science. At
the same time he seems to have avoided giving the work the unsutisfactory aspect of a purely theoretical work on turning over its pages it seems evident that an excellent contribution to a subject hitherto inadequately ireated is here to be found. It does seem as if the index for so comprehensive a book might have been considera--
Sewer Flushing Diagrams. Sbowing how far the Discharye from a Flush
Tank will give a Self-Cleansing Velocity. S. H. Adaus. New York:
Spon \& Chauberlain, 12 Gortlandt
Street. London: E. \& F. N. Spon,
125 Strand. Price $\$ 5$.
125 Strand. Price $\$ 5$.
These diagrams are devoted to data relating to the action of pipe sewers established by actual tests, and, de-
spite its somewhat high price, it is to be trcated as a sine spite its somewhat high price, it is to be reated as a sine
qua non in advanced engineering practice, and hence receives our commendation.
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cents.
This ciagram is somewhat in the same line as the one just spoken of, and is designed for the use of carpenters.
It gives rules for laying out complicated roofs, measuring the timbers and framing complicated roofs iu general.
The Bridgeport Wood Finishing Company have recently issued, more especially for the use of architects, a specimen book containing samples of differ-
ent woods finished with the Wheeler wood filler and the Breinig stains. which is something quite remarkable in
the way of catalogue work. The book containg forty-
$\left\lvert\, \begin{aligned} & \text { eight specimens of oak, mahogany, cherry, cypress, ma- } \\ & \text { ple, whitewood }\end{aligned}\right.$ ple, whitewood, sycamore, curly birch, pine, ash, etc.,
mounted on heavy cardboard, their finely finished surfaces protected by layers of soft cotton, and all showing he great beauty which can be developed in clearly bringing out the natural grain of a wood and finishing it with a high polish, which the materials furnished by this company render entirely practicable. The samples given are but a small percentage of the kinds of wood on which hese finishes are applied, but
The 1897 catalogue of the Keuffel \& Esser Company, of New York, has considerable new
matter, and its entre text and illustrations are well worth nd engineers. The book has 424 pages. aud we are in formed that 400 of its engravings are separately copy-
ghted, as well as the text. The corpany has long held a leading position as manufacturers and importers of rawing materials and surveying instruments, and has a
most enviable reputation for furnishing the widest variety and the very highest qualities of everything which ny one may desire to purchase in their linc. The read zuide to a sound judgment when one is selecting either instruments or materials.

## An experience of nearly fifty years, and the prepara- ion of more thai, one handred thousand apppiinations or patentsat home and abroad, enable us to understand    INDEX OF INVENTIONS <br> For which Letters Patent of the United States were Granted JUNE 15, 1897

AND EACH BEARING THAT DATE
[See note at end of list about copies of these patents.]

A ir brake hose coupling, j. .iëde.ern

 Band cuttere aud feader, I. D. Parmiey.



Belt, concentrator, G. Gates..............
Belts ujustment for concentrator, G.
Bench jee wash bench.
Benzyi morphine, J. F. F. Von Mering.



Bird care bracket, A. Merge
Bit. See bricle bit.
Board. See Meat block. See Ironing board. Plaster board.
oiler., See Pipe boiier. Steam boiier.
oiler water regulator. U. S. Archer.

F. Mower.........
Botte, J. Ma.epart
Bottle, G. C. Pillips
B.

Box. See Feer bux.
Box. E. E V.
Boxes. jars, caniams.
Brace. See Sikater saikie brace
Bracket. See Bird care bracket
Brake.
Yelocipede brake.
Bride, J. H. Semmes.
Bride bit. T. Foga.
Broom co T. .

Butter mould, W. D. Marshall.....
Calendar or oimanac, S. Weghorn


ar coupling, J. A. Richetmire
Car couplin, 1 . Roberton.
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