### A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXIV.—No. 18. ESTABLISHED 1845.

### NEW YORK, MAY 2, 1896

\$3.00 A YEAR. WEEKLY.

THE NEW BRIDGE OVER THE HUDSON RIVER AT NEW YORK.

We present a perspective view of the proposed New York and New Jersey railroad bridge across the Hudson River It shows also the New York approaches and the location of the grand terminal station.

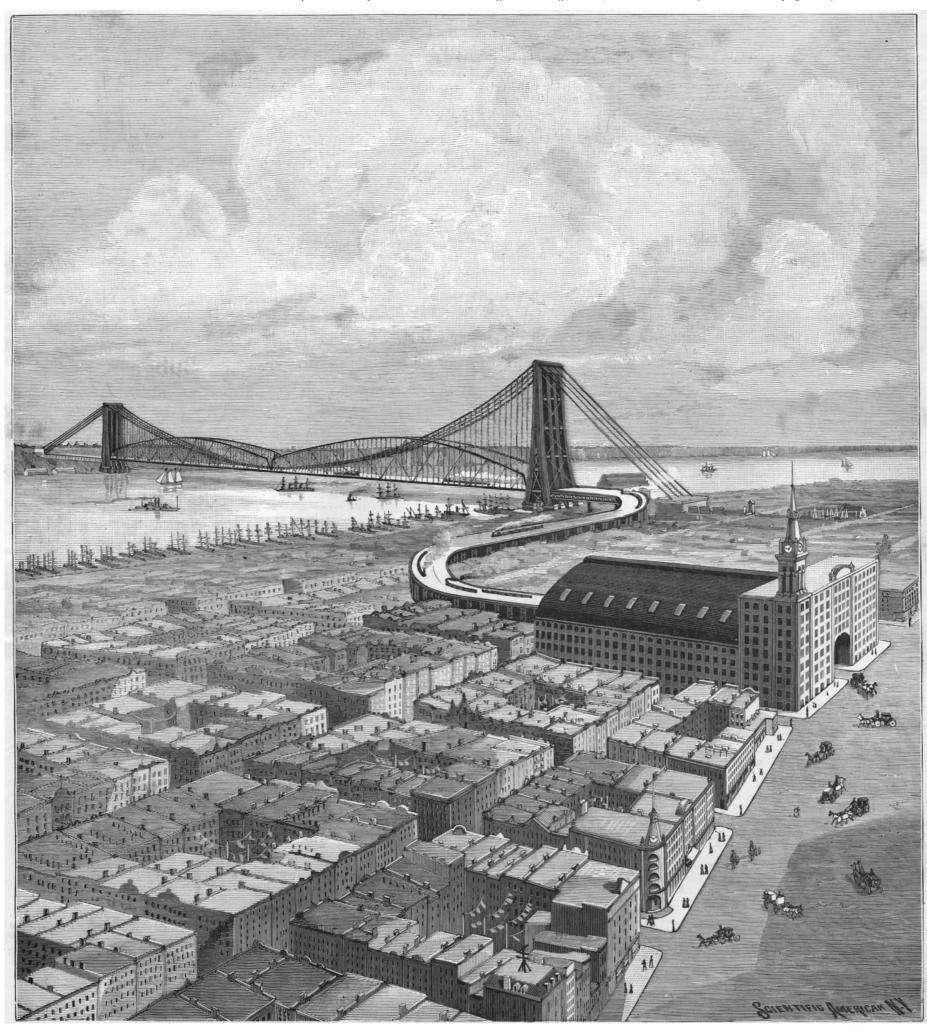
The station will be at the corner of Eighth Avenue, Forty-ninth and Fifty-first Streets. The six track viaduct will run thence west to the block in Fiftieth Street between Tenth and Eleventh Avenues. There, safe to say that it will be the greatest engineering

by a broad curve, the viaduct will sweep northward, mile. The structure will curve to the westward again span of the new bridge will be more than twice the at Fifty-eighth Street, and at Fifty-ninth Street and length and its towers fully twice the height of those Twelfth Avenue it will reach the end of the bridge of the Brooklyn Bridge. structure proper.

The imposing proportions of the bridge and the beauty of its designs are shown in the illustration, and, when we study its dimensions in detail, it is perhaps stream, and, as the War Office requirements demanded

work ever attempted. This can best be understood by constantly rising at a grade of thirty-five feet to the reference to the present Brooklyn Bridge. The main

It was originally proposed to erect a bridge of the cantilever system, with a river span of 2,000 feet. This would have necessitated a tower 1,000 feet out in mid-(Continued on page 279.)



THE NEW BRIDGE OVER THE HUDSON RIVER AT NEW YORK.

# Scientific American.

ESTABLISHED 1845

MUNN & CO., Editors and Proprietors. PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

#### TERMS FOR THE SCIENTIFIC AMERICAN. (Established 1845.)

#### The Scientific American Supplement (Established 1876)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size is issued weekly. Every number contains if octas of pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, for the U. S., Canada or Mexico, \$6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page. Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of seven dollars. To foreign countries within Postal Union eight dollars and fifty cents a year.

#### Building Edition of Scientific American. (Established 1885.)

CERTAINSHER 1883.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders and all who contemplate building this work is invaluable.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, \$2.50 a year. To foreign Postal Union countries, \$3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, \$5.00 a year. To foreign Postal Union countries, \$6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, \$9.00 a year. To foreign Postal Union countries, \$11.00 a year.

#### Export Edition of the Scientific American (Established 1878)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. The SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. \$3.00 a year, post paid to any part of the world. Single copies, 25 cents.

MUNN & CO., Publishers, 361 Broadway, New York. To The safest way to remit is by postal order, express money order, raft or bank check. Make all remittances payable to order of MUNN B. Readers are specially requested to notify the publishers in case of any failure. delay. or irregularity in receipt of papers.

#### NEW YORK, SATURDAY, MAY 2, 1896.

#### Contents.

(Illustrated articles are marked with an asterisk.)

Bacteria in milk	Notes and queries
Balloon, Andree's Arctic 278	Nose bag, Burbank's*
Band saw brazing (6842) 284	Observatory, Royal, Greenwich,
Bicycle bell, Breckwedel's* 279	Eng *
Bicycles, railway carriage of 283	Eng.*
	Patents granted, weekly record
	of 284
Botanical notes 278	Pendulum, an exact 277
Bottle stopper, Wyckoff's* 277	Photographic enlarging on can-
Bridge, Hudson River, New	vas 274
York* 273	Photographic negative defects 279
Candle tree, the 278	Photographic negatives, how to
Clearing nut, the	find 276
Combustion, spontaneous 275	find
Diphtheria and serum treatment 274	Science notes 278
Disinfection of rooms 276	Seeds as weights
Electrical power from Niagara 283	Shadow phenomenon
Electrical speed measuring ap-	
paratus* 280	Ship, the fastest afloat 279
	Shoe black plant, the 278
Flash light powder 279	Sky, the, in May $275$
Fog born phenomena 278	Slate for houses 274
Hand flower tree, the 278	Sorting machine, Paulson's* 276
Hat, safety, for niners* 276	Soudanese warriors* 283
Iceland, Isafjord* 277	Speed of projectiles, measuring
Insect vision	the* 280
Inventions recently patented 284	Telescope, a great German 276
Lace bark tree, the 278	Tooth brush plant, the 278
Lantern slides, new way of mak-	Wasts, intoxicated 283
ing 277	Whisky root
ing	Windmill, Rowan's*
structive action of 274	Wine production the world's 929
Milk, bacteria in	Wine production, the world's 282
	Winking
Moths and beetles 277	Witch hazel ointment 279
Mountain, a moving, in France 275	Women at Khartoum 283
Niagara's power for New York 283	World's Fair awards 282

#### TABLE OF CONTENTS OF

#### SCIENTIFIC AMERICAN SUPPLEMENT

No. 1061.

For the Week Ending May 2, 1896.

Price 10 cents. For sale by all newsdealers.

- PAGE I. ASTRONOMY.—The Planet Venus.—The results of recent observations of Venus, with drawings showing the results.—6 illustrations.
   II. CIVIL ENGINEERING.—Future Water Supply of Greater New York.—The water problem in the great seaboard center of popular contents.
- lation in the United States...... ECONOMICS. The Mineral and Metal Production of the United States in 1895.—The metallic production.—A very valuable resume of the metallic and non-metallic products in the United States during the past year.
- 1V. ELECTRICAL ENGINEERING.—Electric Propulsion by Sub-terranean Conductors.—An excellent article describing a number of typical electrical conduits.—8 illustrations. 16961
- V. HOROLOGY.—Clocks in the Middle Ages.—A most interesting article on the archæology of clocks, with beautiful examples of old time desorative work.—8 illustrations.
- VI. MECHANICAL ENGINEERING. Eighteen Foot Heavy Turning and Boring Mill.—A powerful machine recently brought out by an English firm.—1 illustration...
- VIII. MISCELLANEOUS.—The British Nile Expedition.—A description of English operations in Africa, with graphic illustrations.—
- n one ceners of the public.—3 Hustrations.
  Selected Formulæ.
  Engineering Notes.
  Electrical Notes.
  Miscellaneous Notes.
- Miscellaneous Notes.

  IX. NAVAL SCIENCE.—Rigs of Sailing Vessels.—A popular article, describing a number of characteristic rigs of sailing vessels of many types.—28 illustrations.

  X. NAVAL ENGINEERING.—Water Tube Boilers for the Dutch Navy.—Yarrow tubular boilers built for the Dutch cruisers.—1 illustration.

  XI. PHOTOGRAPHY.—Copying.—By H. C. RAPSON.—Photography of engravings and drawings.—A practical paper on this important
- subject

  XIL TECHNOLOGY.—The Future Cotton Mill.—An interesting paper on the advanced type of cotton mill, its machinery and its

#### THE DESTRUCTIVE ACTION OF LOCOMOTIVE DRIVING cases a total saving of thirty to forty per cent could WHEELS.

The rapid acceleration of railway speed which has taken place in the last few years has developed some new problems in the design of the locomotive; or, to heavy engines the percentage could be less than this. speak more correctly, it has brought into prominent notice certain details of design which, in the earlier locomotives, received but little attention. A sixty-five ton locomotive at rest and a sixty-five ton locomotive running over the track at eighty miles an hour are two very different things. In their action upon the steel rail and the roadbed, there is all the difference between static and dynamic forces, and this difference will increase with the increase of speed. The builders of the early locomotives understood this, no doubt, as well as we do today, but, at the speeds at which they ran their trains, the variations of wheel pressures were not so serious as to call for special attention. The proper counterbalancing of a locomotive is, for obvious reasons, a more difficult problem than that of counterbalancing a stationary engine. The latter is bolted rigidly to a solid bed; whereas the locomotive is hung upon springs, and the whole machine is capable of violent lateral, vertical, and longitudinal oscillations. If it were possible so to arrange the weights in the driving wheels that they would exactly counterbalance all the moving parts of the locomotive, it would be possible to construct a perfectly smooth running engine. But in the ordinary two-cylindered locomotive this cannot be done. As far as the balancing of the revolving weights is concerned, there is no trouble: but to balance the reciprocating parts, such as the crosshead, piston rod, piston, etc., so that at all points of the revolution they shall be perfectly counterbalanced, is a physical impossibility. If they are fully counterbalanced when at the half stroke and traveling at their maximum speed, there will be an excess of counterbalance at the dead centers, when they are at rest. Among the earlier builders it was a common practice to counterbalance all the reciprocating parts; and, on some roads, this is still the practice, though it is more usual to counterbalance only from one-half to two-thirds of these weights. If they are all counterbalanced, there will be a hammering action set up by the excess counterbalance at the full stroke. At the downward half of the revolution, its effect on the driving wheel in which it is located will be to increase the pressure on the rail; and on the upward half it will tend to lift the wheel and so reduce the total pressure. So that instead of the wheel bearing upon the rail with an even pressure, equal at all times to the tension of the springs, it will vary with a range increasing with the velocity of rotation. As the speed increases, this action will become more dynamic in its effect, until a point is reached at which variation in pressure will be so great and so rapid as to set up a positive hammering action upon the rails.

When engineers first began to come in off their runs and complained that at high speed the driving wheels would occasionally lift entirely clear of the rails, the statement was received either with incredulity or ridicule. But when it was found that in a certain case the passage of a badly balanced engine at high speed over a piece of track left a series of regularly spaced depressions in the rail, showing that it had been bent down out of level at these points, locomotive builders began to understand how destructive was this action, and that a force which in its downward action could bend and give a permanent set to a 70 pound rail might conceivably exert an upward pressure greater than the load upon the wheel, and sufficient to lift it clear of the track.

A force that bends a cold steel rail to such an extent as to leave a permanent set in it is destructive to the bridges on a line. This is shown by the sudden snap ping of tie rods at the moment when an overbalanced engine is passing at high speed. These rods are designed to be proportional in strength to the static load of the locomotive and train. The greatest concentration of load is that of the driving wheels; and there are thousands of bridges in existence which have been designed on the assumption that the static load of say from 15 to 20 tons on the drivers was the highest concentration to which they would be subjected. Yet, as a matter of fact, these same bridges are liable to be subjected to the hammering action of an engine which strikes a series of blows of not less than 40 or 50 tons weight.

The evils of overbalancing may be avoided, or reduced to a minimum. in two ways-first by reducing the weight of the reciprocating parts to the lowest practicable limit, and second by counterbalancing only a part of their total weight. There is no doubt but that the weight of pistons, crossheads, and slide valves could in many cases be greatly reduced. Weight could be saved in the case of the piston by designing it in forms which allowed a minimum amount of material to be disposed to the best possible advantage for strength, and also by making it of the highest grade of material. A great saving of weight could be made 

be made on the present weight. With the weight thus reduced it would not be necessary to counterbalance for more than fifty per cent of it; and in the case of

Of course, the unbalanced weight will tend to produce a fore-and-aft oscillation; but this weight will be relatively so small that it will scarcely affect the mass of the engine as a whole.

There is one other element, the size of the driving wheel, which greatly affects the question of balancing. For high speeds it should be made as large as is consistent with a reasonable amount of starting power. The downward blow of the excess balance will vary, other things being equal, with the diameter of the driving wheel, and this is one of the causes, among others, which have led American designers to adopt larger wheels for the latest types of high speed locomotives.

#### Enlarging on Canvas.

Mrs. Allen gives in the St. Louis and Canadian Photographer the following method of enlarging upon canvas: Wash canvas in hot water, rinse with cold, after which stretch to remove all folds. Salting solu-

Potassium bromide	3 parts
Potassium iodide	
Cadmium bromide	1 "
Water 9	40 narts

Thoroughly saturate the canvas with this, and hang in a warm room to dry. Then sensitize with

Nitrate of silver		
Citric acid	1	part
Water1	40	parts

Sensitizing is done same way as salting. Expose in solar camera, or in a similar camera illuminated by electric light. Develop the exposed canvas in

Pyrogallic acid	10	parte
Citric acid	4	"
Water	410	66

Use slightly warm, and about ten minutes is necessary to bring out the picture, thoroughly washing after development. Tone same way as silver prints, with acetate of soda and gold. Fix in hyposulphite of soda.

#### Slate for Houses.

Slate is too much overlooked as a material for inside decoration. It exists in many different shades. It is easy and inexpensive to quarry, and, by far the easiest store to shape into pleasing forms. These qualities render it the cheapest of durable materials for interior purposes, and the wonder is that so little of it is in common use. If large dealers would establish depots of standard goods made up for combination in house building in such forms as would be available to architects, its use would be indefinitely extended. Hardly a cottage of any pretensions would be built where it would not take a prominent part. If such depots were established, house builders would be enabled to see it, and appreciate its beauty and cheapness. As it is, hardly one in five hundred knows anything of either.—Stone.

#### British Association.

The ten presidents for the various sections of the British Association meeting in Liverpool next September have now been chosen. They are Prof. J. J. Thomson, F.R.S., Mathematical and Physical Science Section; Dr. Ludwig Mond, F.R.S., Chemistry; Mr. John E. Marr, F.R.S., Geology; Prof. E. C. Poulton, F.R.S., Zoology; Major Leonard Darwin, Geography; the Right Hon. Leonard Courtney, M.P., Economics; Sir Charles Douglas Fox, M.Inst.C.E., Mechanical Science; Mr. Arthur Evans, F.S.A., Anthropology; Dr. Walter Holbrook Gaskell, F.R.S., Physiology and Pathology; and Dr. D. H. Scott, F.R.S., Botany. Prof. Flinders Petrie, and probably Sir Andrew Noble, will deliver the evening discourses, and Prof. Fleming, F.R.S., will give the lecture to workingmen.

At the Am Urban Hospital in Berlin 411 diphtheria patients were treated in 1894-95, 255 of whom were discharged cured. Of 245 treated with serum, 28 per cent died, while among the 146 who were treated otherwise the mortality was 42 per cent; 53.2 of the serum cases were serious, 237 severe, and the rest slight. No evil effects were observed to follow the use of the serum, and its effectiveness was proportionate to the earliness of its application and the strength of the first doses. The hospital authorities infer from this that it is not an infallible, but a highly valuable remedy.

THE Brooklyn Institute has purchased the Berthold-Neumoegen Collection of Lepidoptera, comprising 40,000 to 45,000 specimens. The institute will also secure the collection of Jacob Doll, of over 55,000 specimens, and will employ Mr. Doll as curator. Edward L. Graef will present his collection of about 20.000. The institution already owns the Calvarey collection, so that altogether the institution will have, says Nature, the most complete collection of lepidoptera in

#### THE SKY IN MAY.

BY GARRETT P. SERVISS.

During this month a splendid opportunity will be afforded for seeing the planet Mercury after sunset, an opportunity which no one should lose, because Mercury, on account of its proximity to the sun, is difficult to catch sight of except under very favorable conditions. It will be visible in the west all the month, but will be best seen about the middle, when it is at its greatest distance from the sun. It attains its greatest eastern elongation on the 16th, when it will be seen shining between the horns of Taurus, a few degrees south of the second magnitude star,  $\beta$ , or El Nath. With a telescope it will then appear in the form of a half moon. Although Mercury is probably at all times an exceedingly hot world on account of its nearness to the sun, yet its orbit is so eccentric that the solar light and heat received on its surface vary to an enormous extent, being more than twice as great at one time as at another, and passing from one extreme to the other in the short space of six weeks. At the time when Mercury is most conspicuous in the sunset sky, about the middle of May, it will be passing from perihelion, a point reached on the 25th of April, toward aphelion, which will be attained on the 8th of June.

While Mercury is on exhibition as an evening star. Venus, the typical evening star when it lies eastward from the sun, will remain inconspicuous in the morning sky, gradually drawing nearer to the sun, behind which it will pass early in July. At the beginning of the month Venus will be in Pisces; at the end in

Mars is a morning star, moving slowly in the course of the month from Aquarius into Pisces, and at the close of the month it will rise about 1 o'clock in the morning.

Jupiter, remaining in Cancer, and slowly drawing nearer the "Beehive" cluster, will continue to be the most brilliant planet in sight throughout the month, and, in fact, throughout the early part of summer. Castor and Pollux in the Twins are so near the great planet that its presence serves to point out those famous stars to persons unfamiliar with the constellations. Being brighter than any fixed star, Jupiter ought to be readily identified, but there is an easy way for those who possess a strong field glass or spy glass to make the identification doubly sure. Such an instrument cannot fail to show one or more of Jupiter's moons, and, in favorable circumstances, all of the four principal moons.

Saturn, in the constellation Libra, rises early in the evening, and by 9 or 10 o'clock is in an excellent position for observation. Being in opposition to the sun, it is, roughly speaking, at its nearest point to the earth, and, consequently, most favorably situated for telescopic study. The earth is not quite so far north of as to secure a cooling effect from an extended air conthe plane of the rings as it was at the end of winter, but the change is not sufficient to cause the rings to appear to the ordinary observer appreciably narrower, and, in fact, the whole planet, in all its dimensions, looks a trifle larger on account of its nearer approach.

Uranus is also in Libra, nearly between the fourth magnitude stars y and z. Coming into opposition on the 12th, it should be visible to the naked eye, but, in order to identify it, the observer should watch it with a field glass, and note its position from night to night in relation to small stars near it. For those who may wish to find it with the aid of a star atlas, I give its approximate right ascension and declination for the beginning, middle and end of the month: On May 1, R. A. 15 h. 22 m., Dec. S. 18° 14'; on May 15, R. A. 15 h. 20 m., Dec. S. 18° 6'; on May 31, R. A. 15 h. 17 m., Dec. S. 17° 56'.

Neptune is in Taurus and Mercury will be near it at the middle of May.

The new moon of May occurs on the afternoon of the 12th; first quarter on the morning of the 20th; full moon on the afternoon of the 26th, and last quarter (the last of the April moon) on the forenoon of the 4th. The moon is in perigee on the 24th and in apogee on the

The moon's monthly calls on the planets strung along the zodiac will take place as follows: Mars on the 7th; Venus on the 11th; Mercury on the 14th; Neptune on the 14th; Jupiter on the 18th; Saturn on the 25th; Uranus on the 25th.

A peculiarity of the starry heavens in the evenings of the month of May is that then the Galaxy, or Milky Way, lies stretched level upon the northern horizon, extending from Scorpio in the southeast around under the pole to Monoceros in west. In the city, or in any neighborhood where electric lights are clustered, of course this phenomenon is practically invisible, but it be heaped in large piles. should be easily seen on a clear moonless night in the open country, unless hidden behind nearby hills.

For the benefit of those using small telescopes I append a few phenomena of Jupiter's satellites, and also of those five of Saturn's satellites which telescopes of moderate size may be expected to show.

On May 1, at 7:37 P. M., Satellite I will enter on the edge of the disk of Jupiter, and at 8:52 P. M. its packing in barrels and boxes becomes a most dangershadow will follow it upon the disk. A little before ous element of spontaneous combustion when by ac-

Jupiter's shadow, and about seven minutes later used for drying metal goods after washing is liable Satellite I will pass off the disk, its shadow following to take fire in a few hours. Spreading so that it may it off at 11:12 P. M.

On May 8, at 9:33 P. M., Satellite I will enter upon the disk, and twenty-three minutes later the shadow of Satellite IV, which will have been crossing the disk since late in the afternoon, will pass off. At about 10:42 P. M. Satellite III will reappear from eclipse, having passed into Jupiter's shadow soon after seven o'clock in the evening. At 10:47 P. M. the shadow of Satellite I will enter upon the disk.

On May 15, at 9:46 P. M., Satellite II will disappear behind Jupiter, and nine minutes later Satellite III will reappear from behind the opposite edge of the planet. At 11:08 P.M. Satellite III will disappear in Juniter's shadow.

In the following list the satellites of Saturn are mentioned in the order of their distance from the planet, beginning with the nearest of the five. The times are approximate: Tethys will be at its greatest eastern elongation on the 12th at 11:15 P. M., on the 14th at 8:30 P.M., on the 29th at 10:56 P.M., and on the 31st at 8:15 P. M. Dione will be at its greatest eastern elongation on the 2d at 9:50 P. M., and on the 13th at 8:30 P. M. Rhea will be at its greatest eastern elongation on the 14th at 8:15 P. M. and on the 23d at 8:50 P. M. Titan is so easily seen that it is hardly necessary to give its times of elongation. It will be east of the planet on the evening of the 2d, west of it on the evening of the 10th, and north of it on the evening of the 14th. Japetus will be near its western elongation, the position in which, owing to some peculiarity of its surface, it is best seen, during the first week of the month. It is just at the elongation point at five o'clock on the morning of the 4th of May.

#### Spontaneous Combustion.

BY G. D. HISCOX.

Although many of the mysterious fires attributed to spontaneous combustion may have originated in some other way, there can be no doubt, from the long record of facts, that a large proportion of such fires are really due to this cause.

The reduction of fire risks is a most important point of economy and of vital interest to many manufacturers, or others that make use of any material or stock that is liable to be made combustible by the application of oil of any kind for facilitating its manufacture. The first care is to guard against the accumulation of such material or stock while in an oily condition, in heaps or in contact with heating pipes, or even in iron receptacles, without providing against its accumulation of heat by its absorption of oxygen from the air. This may be done by spreading such stock so tact and circulation.

In the case of oily waste and rags, especially with painters' rags, one of the most dangerous of this class, when allowed to accumulate, oily sawdust, or any vegetable or woody fiber used for cleaning machinery or the wiping up of waste oil, the only safety is found in its immediate immersion in water.

Oily waste and rags holding any of the lubricating compounds so much in use in engine rooms and on locomotives are perhaps the most dangerous materials to be cared for, but when thrown into out of the way places, they readily become the originators of mysterious fires.

We have often seen the results of throwing a handful of oily waste from a locomotive upon the ties or into the grass at the roadside, which, taking fire in an hour or two, has set fire to ties or grass. Perhaps not a few wooden railroad bridges have been mysteriously set on fire in this way. Journal drippings in flour mills and saw mills are no doubt the cause of many mill fires; started by the accumulation of flour dust or fine floating sawdust upon oily surfaces around journal boxes or where the drippings fall. Dust of any kind from fiber or wood as found in cotton and jute mills, woolen mills and woodworking factories becomes in this manner a source of danger.

The increasing use of cotton seed oil, and the fact that its properties are but little known by the users, is a new source of danger, and needs great caution in exposing it to the conditions favorable for spontaneous combustion.

Like linseed and other vegetable oils, the sprinkling of wool, jute, hemp or other fiber with cotton seed oil for the purpose of manufacture generates heat in the mass, and thus becomes a source of danger. Such material should never be allowed to lie in contact with steam or other heating pipes or surfaces, or to

Sawdust should not be used for absorbing waste oil or drippings, unless it be immediately placed beyond harm by immersion in water or burning in a proper place. Sand is the safest material for such use.

Spontaneous combustion is not confined to oily mixtures alone, for water plays a most dangerous part when the proper conditions are present. Sawdust as

9:50 P. M. Satellite II will reappear from eclipse in cident or neglect it becomes wet. Sawdust in boxes quickly dry is the only safe way of using such material. Empty ice houses have been burned by the spontaneous combustion of a heap of damp sawdust left in them. The careless neglect of removing sawdust from sawmills is a fruitful source of fire. Oil or water may be in contact with the dust and air finishes the work of ignition.

> The mysterious fires in ships loaded with cotton are probably due to excessive moisture reaching the interior of the bales, or possibly to a bale that had been exposed to rain previous to stowage. The shipment of wet bales is a source of danger. Rags in bales on shipboard contain the elements of combustion in the coloring matter and the grease of cast-off clothing, and are in a ready condition for the reaction of the moist air in a ship's hold. They not only heat, but are in a condition for spontaneous combustion from any excess of moisture. The heating of and occasional fires in large heaps of bituminous coal is due to moisture or exposure to rain. Covering or forced ventilation is the usual remedy.

> Fires originating near steam or hot air pipes have been attributed to the partial charring of the wood or fibrous dust by the heat, and its absorption of oxygen from the air. Starch is quickly affected by the heat of steam pipes, and paper holding a starchy constituent is known to become of the texture of punk when left in contact with or near steam pipes, and becomes very susceptible to ignition.

> The explosive flash of the impalpable dust of coal, wood, flour and starch, when lodged on the framework of factories and warehouses, is known by sad experience. It only needs a spark or a lightning stroke for a quick-spreading fire. The electric spark from large running belts is a dangerous element in dusty mills.

> The heating of hav and grain when stored in mows in a damp condition is well known, and in a few cases has been found to be the direct cause of fire. Probably many of the mysterious barn burnings are due to spontaneous combustion. Corn and other grain stored in large warehouse bins heats to a degree that requires constant aeration by changing its place by conveyors, or the injection and expansion of compressed air. Heating soon destroys the grain, and, if continued by neglect, it becomes liable to spontaneous combustion.

#### A Moving Mountain in France.

A phenomenon which, from its remarkable character, has attracted much attention in Europe, recently occurred in the department of Gard, France, where Mount Gouffre, a mass of rock 650 feet in height, suddenly gave way at its base and began moving toward Gardon River, upon the left bank of which it was situated. The movement began on the 15th of February, and on the 23d the advance had destroyed the machinery in the pits of the Grand 'Combe Colliery and nearly a mile of the Alais Railway, and had deflected the course of the Gardon 61/2 feet. Six hundred persons were obliged to leave their homes at Grand Combe, and a water famine having been created, it became necessary to install an engine up stream to pump water from the river to supply the inhabitants of the mining center.

On the 29th the mountain came to a standstill, but it is believed by engineers that this state of rest will be but temporary, and that the rocky mass will resume its motion, cross the Gardon, and finally abut against the mountain that skirts the opposite side of the river. Should this occur, very important geological and topographical modifications will of course be made in the region and it will become necessary to prepare new channels for the Gardon and Gard rivers.

The cause of the accident is shown by the geological structure of the mountain, which consists of grit, green marl, limestone and triassic rocks resting upon a deep bed of clay. These different strata dip at considerable of an angle toward the Gardon. The mountain was therefore influenced by its own weight to follow the slope offered it by this inclined plane. The position was unstable and the danger imminent. Rain or the water of the Gardon must have infiltered and accumulated upon the stratum of impermeable clay, and such infiltrations will have disintegrated certain points of support of the mountain and led to its sliding, which was prepared for by the very arrangement of the ground. The noise made by the mass while it was moving is described as having been frightful.

THE GINGERBREAD TREE.—The Hyphæne thebaica, a species of palm 25 or 30 feet in height, growing in Egypt, Abyssinia, Nubia, and Arabia, produces its fruits in long clusters, each of which contains from one to two hundred. These fruits are of an irregular form, of a rich yellowish brown color, and are beautifully polished. In upper Egypt they form part of the food of the poorer classes of inhabitants, the part eaten being the fibrous, mealy husk, which tastes almost exactly like gingerbread, whence the popular name of gingerbread tree in Egypt.

#### A Great German Telescope.

The Berlin Industrial Exhibition opens May 1, 1896, and in connection with it the Astronomical Observatory of Grunewald will be transferred to Treptow near Berlin. One of the features of the exhibition will be photographs of old instruments, models of telescopes, reproductions of astronomical drawings and kindred subjects. As the largest refractor hitherto erected in Germany has only been one of '18 inches aperture, it is gratifying to note that one is now being constructed having an aperture of 28 inches.

The mounting is so arranged as to receive two objectives, of which one is designed for direct visual, the other for spectroscopic and photographic observations. For this reason the latter will be a double objective of short focal length, 20 to 23 feet, and large aperture, 431/3 inches, which for the present will be exhibited in an unfinished condition, as the means for the purchase and polishing of the enormous lenses, which have been very successfully cast by Dr. Schott, can only be raised during the exhibition. The rough disks of glass for the lenses of the telescope have been furnished by Dr. Schott and Genossen of Jena, while the polishing has been executed by Messrs. C. A. Steinheil of Munich. The mounting of the instrument was intrusted to the Berlin Maschinenbau Anstalt C. Hoppe, "who was assisted" by the firm of G. Meissner, Berlin, in the execution of the minute mechanical portions. The other objective, on the contrary, is completed, and has an aperture of 271/2 inches and a focal length of 68 feet.

Instead of the usual dome, the telescope is provided with a cylindrical protective envelope, which together with the tube is mounted on a rigid box, which can be rotated round the declination axis. The polar axis is placed in the interior of the pier; attached thereto, and therefore revolving round it, is a kind of bell, which incloses the observer's seat; the above mentioned box revolves with the bell round the polar axis. The observer sits in the prolongation of the polar axis in such a manner that his head is in the turning point of the whole telescope, so that he can easily follow its movements by slightly turning his head. The counterpoises for the tube extend at either end of the box: besides which there is attached a second bell, which serves to relieve the polar axis, and for this purpose runs on two antifriction rollers fixed to the pier.

#### AN IMPROVED SORTING MACHINE.

The illustration represents a machine adapted to sort into different sizes not only potatoes and other vegetables and fruit, but a great variety of different substances, the size, strength and other details of the machine being varied accordingly. A patent was re cently granted for the improvement to C. G. Poulson, Jr., deceased, of Linwood, Pa., of whose estate C. G. Poulson, Sr., is administrator. Within the box body of the machine is an linclined screening or separating table, mounted to have end motion, the table consist ing of slats or bars, [which are diamond-shaped in



POULSON'S POTATO SORTING MACHINE.

cross section, and wider apart at the tail than at the head of the table. Beneath the table are hoppers adapted to receive the different sized material passed through the bars at the narrower and wider spaces. The sorting table swings freely on hangers and is moved by turning a crank, on the shaft of which are cams, the table being moved against spiral springs which force the table against a buffer four times for each revolution of the crank shaft. Material shoveled into the machine at the top, as shown in the illustra-

tion, feeds automatically to the proper sized openings is sold without restraint and is in universal use, is spouts, to be conveyed into bags or baskets, or any desired receptacle.

#### A SAFETY HAT FOR MINERS.

A hat designed to withstand blows of falling material, such as pieces of coal, rock, etc., and which is thoroughly ventilated and fits easily on the head of the wearer, is shown in the accompanying illustration, and has been patented by James McNamara and Frederick W. Peppler, of Calumet, Mich. The shell and brim of the hat are formed of a single piece of sheet metal, and inside the shell is a lining or inner



PEPPLER & McNAMARA'S MINER'S SAFETY HAT.

shell of suitable textile material, to the edge of which is attached a leather head band. The inner shell and band are somewhat smaller than the exterior shell, and air holes provide for a circulation of air. The band and inner shell are secured to the outer shell by a series of spring clips, the spring of which allows the band or lining to conform to the head. On the front of the hat is a socket plate to receive the hanger of a miner's lamp. The hat is very durable, is waterproof, will not absorb grease from candles or oil, and the lining may at any time be taken out without ripping or tearing it.

#### Practical Disinfection of Rooms.

The frequency with which second and third cases of scarlet fever appear in houses that have been disinfected by the inspectors of sanitary authorities, says the Lancet, causes grave doubts as to the efficiency of the procedure usually adopted, despite its official sanction. Stripping the walls, lime washing walls and ceilings, and scrubbing woodwork and floor boards with soap and water are indeed effectual enough, and to these when thoroughly done we are disposed to ascribe any successful results rather than to the more technical process of so-called disinfection by sulphur fumes, which is little better than a superstitious rite or incantation shorn of the religious character it had in the mind of Ulysses when he "fumigated" the halls desecrated by the massacre of his wife's suitors after removing the corpses and washing away the blood with a promptness that precluded all thought of other than moral pollution. But in the light of bacteriological experiments dry sulphurous acid fumes, whether generated by burning sulphur or carbonic sulphide, or, as has of late become the fashion, by opening cylinders of the compressed gas, are for all practical purposes useless. The gas would act as a fairly powerful germicide on articles or fabrics previously saturated with water, but its bleaching action precludes its employment in this way with colored materials, carpets, or curtains, and it is as what is called an "aerial disinfectant" that it holds its ground in popular esteem. But aerial disinfection is an absurdity; no one wants to purify the foul air, which is easily enough removed by simple ventilation. In disinfecting a room the true aim is to kill the germs contained in the dust on ledges or in the crevices between the boards, or adhering to the walls and other surfaces, and the dry gas is powerless for this, which is best attained by a sublimate solution of the strength of 1 part in 1,000, or by lime (not white) washing, provided the lime be fresh burnt and caustic; the carbonate or chalk used in whitewashing under the name of whiting, and into which lime is converted by long exposure to the air, being inert. The series of experiments on the infection and disinfection by various means of wall papers, distempers, and other wall surfaces conducted by Dr. Cronberg, under the direction of the late Prof. Uffelmann, at Rostock, showed that subsequent scrapings were invariably and almost instantaneously sterilized by washing or spraying with the sublimate solution, and equally so by lime wash after the lapse of twelve to twenty-four hours. The danger of corrosive sublimate is, we believe, exaggerated, for the smallest fatal dose for an adult being probably three to five grains—equal teeth on the main gear wheel mesh with a gear wheel to at least a quarter of a pint of the solution-acciden- on the upper end of a vertical shaft which has at its tal poisoning with the solution is practically not problower end a bevel gear meshing with a similar gear on able, and as a further safeguard it might be colored a horizontal shaft carrying a pulley from which power

between the slats, when it instantly drops into the more dangerous on that account, and is, indeed, frequently employed with suicidal intent and with fatal effects. In France, Germany, and Italy sublimate has nearly superseded all other disinfectants and its neglect in this country is inexplicable. As to carpets, curtains, bedding, and clothing, all that is capable of being washed should be plunged in a copper of boiling water for a quarter of an hour and such articles as would be spoiled by this treatment should be disinfected by

#### How to Find Negatives.

Much time is lost and patience expended in what is very often a futile search for some particular negative. Perhaps an hour, or even more, is wasted by hunting through two or three hundred of one's photographic successes and failures. To obviate this expenditure of time, we would like to suggest a method of indexing that the writer has found very useful.

The pecuniary outlay for the necessary materials is trifling, and is covered by a few pence. Two note books, indexed, are all that one requires. The one contains a numerical, the other an alphabetical, in-

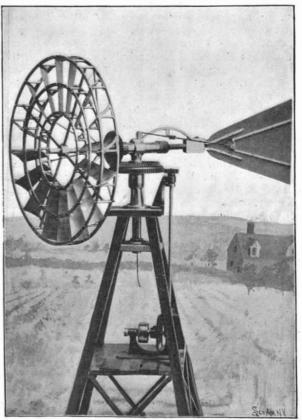
Empty plate boxes are used for storage purposes. Every box should have a gummed label affixed upon the side of the box, each label bearing its own distinctive number. Plate boxes when filled may be kept ranged on a shelf like so many books. A system of double indexing is used.

The numbers 1, 2, 3, etc., refer to the boxes; under the alphabetical headings are found the titles or subjects of the various pictures. A concrete example will perhaps make my explanation more lucid.

One wishes to find a negative exposed, let us say, in Guernsey. Reference to the letter G in the alphabetical index shows one that Mail-boat Approaching Guernsey 6:30 A. M. is stored in box 12. By adopting this method much time and temper is saved.-The British Journal Almanac.

#### A DURABLE AND EFFICIENT WINDMILL.

The illustration represents a windmill of substantial construction, with thoroughly braced and rigid fans or blades, and powerful gear mechanism for transmitting power from the windwheel to a shaft from which the power may be taken. The improvement has been patented by W. McD. Rowan, of Garden City, Kansas. Secured to the timbers of the tower is a platform supporting a hollow post having an annular flange supporting the main gear wheel, whose hub fits over the flange and rests on ball bearings. This gear wheel has vertical and beveled teeth, the latter engaging a bevel pinion on the horizontal shaft carrying the windwheel, the bearing of this shaft being secured to the upper end of a vertical hollow shaft projecting down through

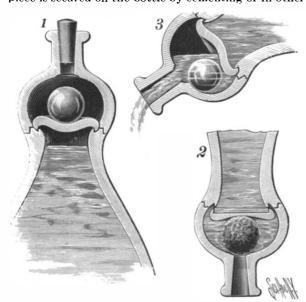


ROWAN'S WINDMILL.

the hollow post. A curved brace extends from this bearing to the bearing of the hinged tail or vane, which may be moved to throw the wheel out of the wind by means of a cord or cable passing over suitable guide pulleys and down through the tower. The vertical with indigo or "laundry blue." Carbolic acid, which may be taken in the usual way.

#### A BOTTLE STOPPER AND MEASURING DEVICE.

A valve stopper designed to prevent the refilling of a bottle after it has been emptied, and one with which the contents of the bottle may be discharged in measured quantities, is shown in the accompanying illustration. The improvement has been patented by Cornelius E. Wyckoff, of No. 365 State Street, Brooklyn, N. Y. Fig. 1 represents the stopper in a bottle, the latter being in upright position; Fig. 2 shows the bottle inverted, its contents then filling a measuring space, and Fig. 3 shows the position of the parts as the measured quantity is being discharged. The cap piece is secured on the bottle by cementing or in other



WYCKOFF'S BOTTLE STOPPER.

desired manner, after the bottle has been filled, the in terior wall of the cap piece being substantially hemispherical, and having a contracted outlet to be fitted by a cork. About where the cap piece is fitted on the bottle is an annular groove forming a seat for an an nular flange of a plate valve, on which rests a spherical body serving as a valve stopper for the inverted bottle, as shown in Fig. 2, while also allowing the plate valve to fall sufficiently away from its seat for the passage of material into the measuring device. When the bottle is tilted to the position shown in Fig. 3, the spherical body rolls to the lower side and forces the plate valve to its seat, thus preventing a further discharge of the contents of the bottle to the interior of the cap, while permitting that which is in the cap to be poured out. Where a continuous flow is desired from an inverted bottle, the spherical body is made with interstices or hemispherical depressions in its surface.

#### ISAFJORD, ICELAND.

We present an engraving, for which we are indebted to L'Illustration, of Isafjord, Iceland, which is one of scenery here is magnificent, the country presenting the appearance of the fiords of Norway and Sweden. The snow remains on the mountains until the middle no odor, but one should remember that it is very idea was suggested that it might be used on glass.

of summer. Tourists have had some thrilling adventures in climbing the mountains back of the little village. The bay is capable of holding the largest navy in the world. There are three whalebone fisheries near this

Whalebone has become very scarce and it now commands a large price. The name whalebone, under which the baleen plates of the right whale are popularly known, is a misnomer and the trade name of whale fin is equally inaccurate. Of the three kinds of whalebone which are found in commerce, that obtained from the Greenland whale, Balaena mysticetus, is the most valuable, and was one of the great staples of northern countries when the whale fishery was a large industry. To prepare whalebone for the market, the blades or plates are boiled for about twelve hours till the substance is quite soft. In this state it can be cut into narrow strips or into small filaments, according many unique properties which render it of great value. It is light, tough, flexible, and fibrous. The fibers run parallel with each other without intertwisting. The use of whalebone dates from 1808, when Samuel Crackles patented its use for brush making. Various special machines have since been devised for cutting the material into filaments. Whalebone was formerly used in the manufacture of umbrellas, but steel has now taken its place for this purpose. Whalebone is now principally used by dressmakers, milliners, and brushmakers.

#### Carpet Moths and Beetles.

In last week's Scientific American directions were given for preserving clothing and furs from the depredation of moths. We now copy from the Carpet and Upholstery Trade Review directions for protecting carpets and upholstery from moths and beetles. In the good old days, when camphor was sold at a reasonable price, it was the first resource of most housekeepers in their struggles against these villainous vermin, but in view of the extremely high cost of camphor nowadays and the ridiculously low price of carpets, it seems advisable to select some less precious article as a protection against those insects whose appetites work such havoc among woolen floor coverings. Moreover, camphor, however liberally used, is not regarded as a certain protection. Among the substitutes for camphor, which are less expensive and more efficacious, are: Benzine, corrosive sublimate, kerosene oil and carbolic acid. It is said that corrosive sublimate is the only sure defense against the buffalo carpet beetle. In utilizing this drug, take a wide mouthed earthen jar, pour into it two quarts of boiling water and dissolve in this one teaspoonful of corrosive sublimate. As the solution is poisonous, the jar should be plainly labeled and kept carefully covered. When possible it should be used out of doors, and applied with a small whisk brush kept for this purpose only. Gloves should be worn in using it, and care taken to prevent any of it touching the face or eyes. In applying it to rugs or carpets the best method is to hang them over a line, then dip the whisk into the liquid, shaking it nearly all off against the inside of the jar; then carefully brush the rug over both the right and wrong sides, without using enough of the solution to make the fabric wet. It is sufficient to slightly dampen the outside. The liquid will not injure any textile fabric, however delicate.

Benzine or kerosene oil will always kill the insects, if it can be brought into contact with them, and the mere odor of the benzine will kill the larvæ. When it is evident that a house has become infested, the carpets should be taken up and all the cracks and crevices in the floor and under the baseboard filled with benzine, a hand atomizer being used for the purpose. The carpets should also be beaten and then lightly sprayed with benzine. The cracks should then be filled with a mixture of plaster of Paris and water, which will soon set and form a hard substance which the insects canthe principal seats of the whalebone industry. The not enter. In the case of a stock of carpets the benzine spray alone is generally sufficient to kill the insects. The benzine evaporates quickly and leaves

to the use to which it is to be put. Whalebone possesses inflammable and that no light should be brought near it.

#### A NEW BICYCLE BELL.

The illustration represents a bell for use with bicycles, the bell being rung with a continuous electric alarm effect by simply pressing on a lever on the handle bar. The improvement has been patented by Harry B. Breckwedel, of No. 315 West Forty-eighth Street, New York City. In clamps which may be readily secured to the rear braces of any bicycle is journaled a spring-pressed shaft carrying a swinging bell frame, the springs normally holding the outer end



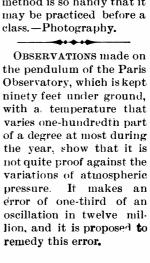
BRECKWEDEL'S BICYCLE BELL.

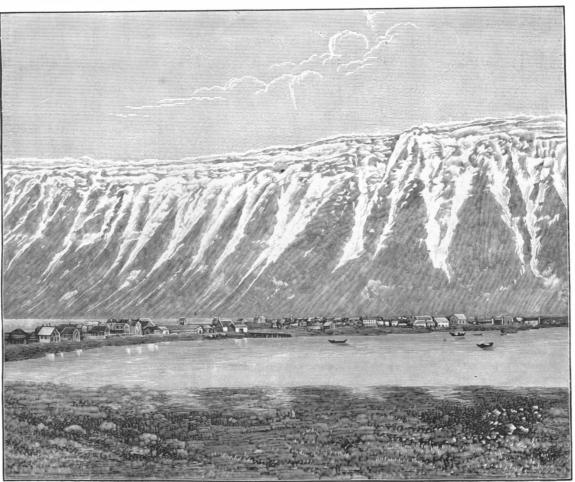
of the bell frame up from the tire, as indicated by the dotted lines. The bell frame carries, at its outer end, rubberfaced rollers adapted to engage the tire, and on the shaft to which the rollers are secured is a stud adapted to be engaged at each revolution of the rollers, by an arm projecting forward from the hammer, as shown in the small figure, a spring holding the hammer normally out of operative position. From the other end of the bell frame a fine steel wire extends through guides to a lever pivoted on the handle bar, where it may be conveniently engaged by the hand of the user. By pressing with the thumb upon this lever, the hands being in the ordinary position on the handle bar, the outer end of the bell frame is depressed and its wheels are consequently rotated by the tire of the bicycle, each revolution of the small wheels causing a blow to be struck upon the bell and the ringing being automatic as long as the pressure is continued.

#### Lantern Slides.

A method of making slides for the lantern other than in the ordinary way is described by Dwight Lathrop Elmendorf, who says that, finding the lantern slide was a very useful piece of apparatus in teaching, he cast about for some method of quickly and inexpensively making a slide. Making a transfer one day, the

> So he placed on a suitable glass a piece of black carbon transfer paper, a drawing being placed on the top and traced upon the glass. When thrown upon the screen the effect was like a charcoal drawing, and answered fully the experimenter's hopes. Unless it is desired to specially preserve the slide, no cover glasses are necessary. He points out that old plates-ordinary or for slides-may be fixed, then washed, and the designs drawn upon them for colored subjects. The method is so handy that it class.—Photography.





ISAFJORD ICELAND.

#### Science Notes.

Hajak, of Vienna, says that smokers are less liable to diphtheria and other throat diseases than nonsmokers in the ratio of one to twenty-eight, says the Medical Age. Schiff remarks that smoking should be positively forbidden in bacteriological laboratories, because it tends to hinder the development of the

Russia was declared free from cholera on February 24 for the first time since the year 1888.

Scrumpox is a new disease to which football has given rise in England, says the Medical Record. It is a pustular eruption, coming indirectly from dirty jerseys and affecting especially the forwards in Rugby football, who have to shove in scrimmages. It has been proved to be contagious. Bacterioscopic examination has shown the presence of the staphylococcus pyogenes aureus.

The work on Herr Andrée's balloon is proceeding rapidly. A balloon house is to be erected in Spitzbergen. It will be octagonal in shape, 25 meters high and 37 meters broad. The walls and floors will be lined with felt at such points where the balloon will be liable to touch them. The roof will be covered with cotton cloth and the windows will be of gelatine in place of glass. The steamer on which the expedi tion will set out for Spitzbergen will carry about 35 tons of sulphuric acid to generate the hydrogen.

The St. Louis Observatory at St. Helier, in the island of Jersey, contains some interesting instruments. The observatory is situated on a small, open plateau, above the Jesuit College. It has a tower of the Eiffel type, about 170 feet high; access to the top is obtained by a spiral staircase. A number of instruments at the top are connected by a cable of electric wires with recording apparatus in the observatory proper. Among the special features of the apparatus used is an anemometer of special design. A T-shaped support with orientating arrangement bears on one arm an anemometer with half cylinders instead of the usual cups, being thus made sensitive, it is claimed, to horizontal components and horizontal currents only; while a helical fan on the other arm takes care of the vertical components. It is a curious fact, says Nature, that at this station, as at the Eiffel Tower at Paris, the diurnal variation of wind velocity shows an opposite character near the ground and at the top of the tower; in the former case the velocity reaches its maximum about midday and in the latter about mid-

In a recent communication to the French Academy of Sciences, says the American Shipbuilder, an explanation is given of some of the curious phenomena pertaining to fog horns. It has been found that, with acoustic signals or sirens, they are surrounded by a neutral zone, in which the sound is not heard at the sea level. This zone is more or less distant, according to the height of the siren on the coast, and it has a main width of about 8,400 feet. On the nearer side of this zone the sound is heard perfectly. But when it is traversed, the sound weakens gradually until it becomes almost imperceptible, when it increases again, and, on the zone being finally left behind, the sound resumes its full intensity. Experiments have been made with a vessel by causing it to approach and recede from a lightship in various directions in a straight line. In each course the sound was deadened almost completely in a zone whose central line was about 15,000 feet from the siren.

Some interesting experiments, by Plateau, in insect vision are recorded in the Bulletin of the Belgium Academy. In a bed of bright colored dahlias he concealed from search the highly colored rays of some of the flowers, exposing only the disk, and in a second series of experiments the disk also, but independently, either by means of colored papers or by green leaves secured in place by pins. Butterflies and bees sought these flowers with the same avidity and frequency as the fully exposed flowers in the patch, the bees par- ing the forests which are composed of this tree might impurities fall to the bottom, leaving the water clear. ticularly pushing their way by the obstacles to reach them. From this M. Plateau concludes that they are fruits are suspended from all the stems and older for the same purpose in Egypt, and those of kola or guided far more by their perception of odors than by branches. They have a peculiar applelike odor, which sterculia in Sierra Leone. Dr. Pereira states that the their vision of bright and contrasted colors. In the communicates itself in some degree to the cattle fatsecond communication, says Psyche, Plateau gives the details of another set of experiments to determine previous to killing, the food be changed. whether a wide meshed net presents any obstacle to the passage of a flying insect which could easily pass in flight through the interstices. He found that while such nets do not absolutely prevent passage on the wing, insects almost invariably act as if they could not distinguish the aperture, frequently ending by alighting on the net and crawling through. He reasons that through the lack of distinct and sharp vision, the threads of the net produce the illusion of a continuous surface, seen at a distance.

Preparations are being made for an unusual kind of transatlantic trip for a party of American physicians, who intend to start about July 1. The party will be limited to one hundred. Each member must be a physician in actual practice and a graduate of au American university. They will inspect the principal The most interesting of these is the G. domingensis, a health resorts of Europe. It is expected that various common creeper in the West Indies and Brazil. In

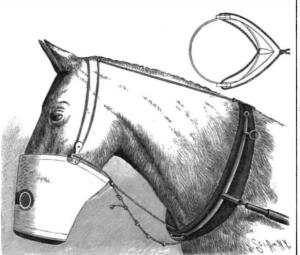
lieved that they will be received with the greatest courtesy by prominent surgeons and physicians.

The will of Benjamin Franklin was allowed in the Probate Court of Suffolk County, at Boston, on March 26, on the petition of Mayor Quincy, as a foreign will, having been probated in the Orphans' Court in Philadelphia. The probate of the will in Boston was deemed necessary in view of the legal disposition of the "Franklin Fund," which was created by the will of Benjamin Franklin, and which now amounts to several hundred thousand dollars.

The bill to provide for a director-in-chief of the scientific bureaus of the agricultural department has been reported favorably by the Senate committee on agriculture.

#### FEED SAVING NOSE BAG.

The illustration represents a nose or feed bag adapted to be so applied to the head of a horse that the latter will be prevented from throwing the feed out of the bag by tossing his head. The improvement has been patented by Clement E. Burbank, of No. 31 Eighth Avenue, New York City. At opposite sides of the top of the bag are pulleys through which is passed a cord to form double loops over the head of the horse, and the rear loop is connected by an extension of the cord to the check hook, so that when the horse lowers his head to reach the feed at the bottom of the bag the latter is raised slightly to bring the feed within easy reach. On the inside upper rear edge of the bag are side extensions of somewhat triangular form, which fold over to form pockets, in the edges of which are drawstrings, as indicated by the small figure. Each cord or drawstring passes across the interior of the feed bag at the rear and around a pulley, extensions of the cords being carried back and knotted, to be engaged by a hook secured to the breast collar of the harness. When the horse tosses his head these cords are tight-



BURBANK'S NOSE BAG.

ened, drawing the pocketlike extensions in the rear of the bag close against the under side of the horse's jaw, and thus preventing any waste of feed. In taking off the feed bag, these cords are disconnected from the collar and secured around the bag itself, one of the cords passing through a loop on the front of the bag.

#### Botanical Notes.

The Candle Tree.—The genus Parmentiera (named after Aug. Parmentier, who did much for economic botany) embraces two American species, the fleshy, cylindrical fruit of one of which may be compared to a cucumber and that of the other to a wax candle. Indeed, in the Isthmus of Panama, the latter (P. cereifera) is termed the candle tree or Palo de Velas, because its fruits, often four feet long, have a striking resemblance to yellow wax candles, and a person enteralmost fancy himself in a candle factory, for these Bitter almonds, by the way, are said to be employed tened upon them, but which disappears if, a few days

The Shoe-black Plant.—Hibiscus Rosa-Sinensis, a well known greenhouse plant, is a native of India, China, and other parts of Asia. In its native countries it is a tree of twenty or thirty feet in height, and bears flowers that are very variable-double, single, red, purple, white, or variegated, according to the particular variety. These flowers contain a quantity of astringent juice, and when bruised rapidly turn black or deep purple. They are used by the Chinese women for dveing their hair and evebrows, and in Java for blacking shoes, whence the plant is called the shoeblack plant.

The Toothbrush Plant.—The genus Gouania embraces upward of twenty species of climbing shrubs, most of which inhabit the forests of tropical America. cities will entertain the party officially, and it is be- Jamaica it is called chaw stick, on account of its thin, de Nueva España.

flexible stems being chewed as an agreeable stomachic. Toothbrushes are also made by cutting pieces of chaw stick to a convenient length and fraying out the ends, and a tooth powder to accompany the use of the brush is prepared by pulverizing the dried stems.

Toothpick Plants.—Ammi Visnaga, an umbelliferous plant, is called the toothpick bishop-weed on account of the use made in Spain of the rays or stalks of the main umbel. These, after flowering, shrink and become so hard that they form convenient toothpicks. After they have fulfilled this purpose they are chewed, and are supposed to be of service in strengthening the gums. The spines of Echinocactus Visnaga are in common use among the Mexicans for the same purpose. The number of these spines upon a single plant is something enormous. A comparatively small plant in Kew Gardens was estimated to have 17,600, and a large specimen at the same place could not have less than 51,000.

The Hand Flower Tree.—This tree, the English name of which is a literal translation of Macpalxochiquahuitl, the somewhat cumbersome name by which it was known to the Aztecs, is the sole species of the genus Cheirosteman. The arrangement of the stamens in the flower of this plant is most remarkable. They are of a bright red, and are united for about a third of their length (four inches), when they separate into five curved clawlike rays, and thus bear some resemblance to a human hand. A solitary specimen of this tree was first discovered growing near the town of Toluco, in Mexico. It was of great age and an object of veneration among the Indians, both on account of the remarkable structure of its flowers, and because they supposed no other tree of the kind existed elsewhere; but forests of it have since been discovered near the city of Guatemala.

The Sack Tree.-From a species of Antiaris (the genus which includes the celebrated upas tree) sacks are made in Western India by the following singular process. A branch is cut corresponding to the length and diameter of the sack wanted. It is soaked a little, and then beaten with clubs till the fiber separates from the wood. This done, the sack formed of the bark is turned inside out and pulled down till the wood is sawed off, with the exception of a small piece left to form the bottom of the sack. These sacks are in general use in Western India.

The Lace Bark Tree.—The tree producing the wellknown lace bark of Jamaica is called in that island by the name of Lagetto. The inner bark of this tree (the scientific name of which is Lagetta lintearia) consists of numerous concentric layers of fibers which interlace in all directions, and thus present a great degree of resemblance to lace. It is said that Charles II received as a present, from the governor of Jamaica, a cravat, frill and pair of ruffles made of this material, and it is to this day used for bonnets, collars and other articles of apparel by Creole ladies.

Seeds as Weights.—The beautiful black spotted scarlet seeds called love pease (Abrus precatorius), which are much used for necklaces and other ornamental purposes, are employed in India as a standard of weight under the name of "rati." The weight of the famous Koh-i-noor diamond is known to have been ascertained in this way. The seeds of the carob tree (Ceratonia Silique) are said to have been the original carat weights of the jewelers.

The Clearing Nut.—Notwithstanding the venomous nature of the species of strychnos whence the drug nux vomica is derived, the seeds of another species (S. potatorum) are used in India for clearing muddy water. The natives never drink clear well water, if they can get pond or river water, which is almost always impure, according to circumstances. One of the seeds of the clearing nut tree is well rubbed for a minute or two around the inside of the vessel (generally an unglazed earthen one) containing the water, which is then left to settle. In a very short time, the efficacy of the clearing nuts depends upon their albumen and casein, which act as fining agents, like those employed for wine or beer.

Whisky Root.-A plant belonging to the genus Anhalonium, of the order Cactaceæ, which has long been known by the name of whisky root, from its effects on the system, which resemble those produced by alcoholic drinks, has recently attracted some attention as a stimulant and nerve tonic new to materia medica. The part of the plant used is what is popularly called the "button." This is sliced by the Indians of Southern Texas, and the small pieces being chewed and the juice swallowed, the intoxicating effects follow. it is said, in about the same time as would those of a drink of whisky. The Indians sit for hours enjoying the beautiful visions of color and other manifestations caused by the intoxication. There are several species of the genus, one of which was known to the Aztecs as pevotl, and the intoxicating effects of which are briefly described by Sahagun.—Hist. Universal de las Cosas

## NEW YORK.

(Continued from first page.)

that the river navigation should be unobstructed, it was determined by the company to attempt the bridging of the Hudson River by a mammoth suspension bridge, with a great central span of 3,254 feet.

If there is one part of a bridge of greater importance than another, it is the foundations, and in the present case they are of colossal size and carried down to unusual depth. Beneath each tower there will be sunk eight steel caissons, forming in plan an oblong 85 feet by 168 feet between centers of caissons. At the outer corners of this oblong there will be four large caissons 62 feet in diameter; between them will be four 35 foot caissons. These will all be sunk to a depth of about 150 feet below the water level, until they rest upon solid rock. They will probably be sunk by the open dredging process, such as was employed by the Union Bridge Company (the contractors for the present undertaking) in building the Hawkesbury River bridge in Australia. The caissons will be so arranged that the pneumatic process can be adopted if necessary. They will rise to within 10 feet of the water level and will be filled with concrete; above this the piers will be carried up in solid granite masonry to a height of 30 feet above water level. Upon the granite foundation will stand the eight columns of the towers, rising to a total height of 587 feet above the water level. They will be built of steel plates and angles and will be strongly tied and braced together. The river and shore legs of columns will incline inwardly and meet at about two-thirds of their height, from which point they will be carried up as a single construction, as will be seen by reference to our engraving.

Strung across the towers will be twelve steel cables each 23 inches in diameter; each cable will consist of a large number of steel wires, about 3 inch in diameter, laid parallel and bound together with a wire wrapping. The wire composing the cables was originally intended to have an ultimate breaking strength of or contaminated developer, excess of alkali, or dete-180,000 pounds to the square inch, but recent improvements in the manufacture of steel wire make it likely that the engineers will be able to secure wire of the strength of 200,000 pounds to the square inch. On the New York side the cables will be carried down to anchorages which will consist of two solid masses of masonry 180 feet square and 150 feet high. On the New Jersey side they will be carried down through tunnels far into the solid rock and secured to massive plate girder anchorages. The twelve cables will be hung in parallel vertical planes, and contrary to the usual custom, they will not be "cradled." There will be four cables over each of the outside columns of the tower and two over each of the intermediate columns.

To prevent any deformation of the floor of the bridge under the action of a moving load, it will be provided with two large stiffening trusses, each of which in itself will be longer than the central span of the Brooklyn Bridge. Each truss will be 1,600 feet long, 125 feet from center to center of trusses, and 200 feet deep at the center. Their ends will be hinged where they meet at the center of the span, also where they rest upon the towers. They will be divided into 40 foot panels, and at each panel point will be a plate steel girder 7 feet deep and 144 feet long, reaching across the full width of the bridge from truss to truss.

At each panel point the trusses, girders and whole floor system will be suspended from the main cables by twelve steel wire suspenders, which will be attached to the floor beams as follows: Two immediately on each side of the trusses and two at two intermediate points; there will be twelve lines of plate stringers, 5 feet deep, running through the whole length of the bridge, one under each rail. Above each floor dried, and takes place gradually, it is due to insuffibeam, and high enough to give headway for the cient fixing and the presence of undissolved silver salts. trains, will be a deep supplementary lattice work girder, riveted at its extremities to the vertical posts of the truss. The floor beam will be suspended from opportunity to act longer on one part of the plate than this upper girder at two intermediate points of sup-

the wind pressure; the former lightly, the latter very ing, or to allowing the plate to remain for a long time strongly. The trusses will be hinged at the center to in a pyro developer, without rocking. allow for a lateral movement, and the wind pressure will be resisted by the enormous dead weight of the trusses and floor system. Under the action of the wind the trusses will move out sidewise and thereby the suspenders will become inclined and will transfer part of the wind pressure directly to the main

The maximum loads for which the bridge is designed are as follows: Dead load, about 40,000 pounds to the lineal foot; live load, 18,000 pounds to the lineal foot; wind load, about 1,600 pounds to the lineal foot.

There will be six railroad tracks, and the bridge is to be strong enough to carry all the tracks loaded with trains from end to end, or a total live load of about 30,000 tons; the maximum strain on each cable will be about 8,300 tons, or a maximum of and boroglyceride; lastly, add the extract of witch than 300 tons displacement. So that the Cunard ship 100,000 tons on the whole twelve. It will be noticed hazel. Perfume with oil of lavender. This makes an which is 43 times as big only takes 4 times as much that the shore spans are not suspended from the ca- excellent toilet cream.

THE NEW BRIDGE OVER THE HUDSON RIVER AT bles, but consist of a number of steel trusses carried upon independent piers.

The cables are attached rigidly to the top of the tow ers, and do not, as usual, rest upon sliding saddles. The variations of strain in the towers, resulting from the alterations of load and temperature, will be as follows: Maximum strain in the river leg will occur under full load and high temperature. Maximum strain in the shore leg will occur under full load and low temperature.

It is estimated that the bridge itself will cost \$25,000,000, and the cost of the whole, bridge, approaches and terminal works, will be about \$60,000,000.

Should there be no legal or other obstructions, it is estimated that the work can be completed in eight

The design illustrated was made by the Union Bridge Company, of New York City. Our thanks are due to Mr. Charles Macdenald and Andrew Onderdonk, of this company, and Joseph Mayer, the engineer, for particulars received.

#### Defects in Negative3 and Their Causes. BY CHARLES L. MITCHELL, M.D.

So many amateurs are at a loss why certain defects occur in their negatives, and how in many cases they can be obviated, that the following summary of a few of the most prominent may perhaps be of aid to many a disheartened photographer:

Fog indicates either decomposition of the emulsion (a defect common in all extremely rapid plates), accidental exposure to light, over-exposure, or over-development. If the negative is foggy all over, excepting where covered by the rabbet of the plate holder, it indicates that the effect was produced in the camera, either by light leaking through some hole in the bellows, or through flange, woodwork, dark slide of plate holder, or that the plate was over-exposed, or that the sun was shining directly on the lens. If the edges covered by the rabbets are also fogged, it indicates light leaking into the dark room before development, rioration of the plate. If the plate is partially fogged. in streaks, it indicates leakage of light at the junction of plate holder and camera, or at the edges or corners of the plate holder, or perhaps a leaky or burst corner of the plate box.

Abundant detail in the shadows, but lack of contrast, and general thinness of the negative, indicate over-exposure, too much alkali in the developer, the use of a spent developer, or using a weak developer for too short a time, or want of light and shadow in the subject.

No detail in the shadows, with excessive contrast, indicates too short an exposure, too great a contrast in the lighting of the subject, or the use of a developer very strong in restrainer.

Clear shadows and weak contrast are due usually to insufficient development.

Round or oval clear spots, with sharp dark edges, are caused by air bubbles clinging to the plate during development.

Pin holes and very fine clear spots are due to either dust on the plate during exposure, or (although the plate makers say not) a dirty, poorly filtered and impure emulsion. Small particles of insensitive haloid salts of silver remain in the emulsion, are not acted upon by light during the exposure or by the developer. and hence when the plate is placed in the fixing bath, they dissolve out and clear a clear place in the film.

Yellow staining of the film is caused by prolonged development with a developer that is either very old. nearly spent, or contains too little sulphite. Also, by fixing in an old, used up fixing bath. Where the staining occurs after the negative has been fixed and

Irregular lines are due to delay in entirely covering the plate, at once, with developer, thus giving it an another.

General mottling of the film is due to contact of the Both top and bottom chords will be braced to resist face of the plate with impure paper, to imperfect fix-

Clear corners means that the lens does not fully cover the plate.

Bare places or patches of uneven density (noticed particularly in films) indicates that the plate or film has not been evenly coated with the emulsion, and that while in some places a pool of it has formed, it has left other places nearly bare.—The Photographic

#### Witch Hazel Ointment, Lanolin......oz. 4 Petrolatum. ..... " 12 Distilled extract witch hazel .....

Mix the landlin and petrolatum: add the glycerin

#### Correspondence.

#### Interesting Shadow Phenomenon.

To the Editor of the SCIENTIFIC AMERICAN: The composing room of this office is lighted by incandescent electric lamps, supplemented with gas jets fitted with Welsbach incandescent mantles. If either illuminant is used singly, ordinary dark shadows are cast when the light is intercepted. When the two lights are burning simultaneously, an extraordinary phenomenon is observed, viz., colored shadows, the direct electric rays casting a dark green shade and the incandescent mantle an orange drab. At the point where the shadows intersect each other the shade becomes denser and of a dark drab color, the green being completely destroyed by the orange drab SAMUEL THOMSON.

Titusville, Pa.

This seems to be a phenomenon partly of the subjective order, the shadow cast by one light being illuminated by the light of the other. The great difference in color of the two lights causes the difference in the colors of the shadows.—ED.]

#### Flash Light Powders.

To the Editor of the SCIENTIFIC AMERICAN:

I note that in your query and answer column of the March 28 issue of the Scientific American, you give several formulas for making photographic flash light powder. One of these is: Magnesium powder, 6 ounces; potassium chlorate, 12 ounces; antimony sulphide, 2 ounces.

I believe it will be well to call attention to the fact that mixtures of this nature, containing potassium chlorate or perchlorate, are extremely dangerous, for several reasons, and the making and handling of them must be carried on with the greatest care. Chlorate or perchlorate mixtures are, in the first place, sensitive to friction. This danger is one which may be met with both in manufacture and use, and especially in transportation.

In the second place, they are liable to spontaneous combustion, due to decomposition, which may set in sooner or later; and third, the explosion of these mixtures is of such a violent nature that serious accidents are most certain to obtain.

A few months ago a photographer's gallery in Chicago was nearly demolished by the explosion of a flash light mixture in which potassium chlorate played an important part, and a few weeks later in the same city a chemist had his right hand so badly torn that it had to be amputated. This was the result of an endeavor to compound a flash light powder in which potassium chlorate was used as the oxidizing agent.

I believe your readers will appreciate this statement, which will serve to caution any of them who are inclined to attempt to make any photographic flash light powder containing potassium chlorate or perchlorate. It will be well for those who are not versed in such matters to leave such mixtures alone SAMUEL RODMAN, JR. entirely.

Chicago, April 18, 1896.

#### The Fastest Ship Afloat.

This is an age of record breaking; and record breaking for its own sake too. The wish to have the biggest, tallest, fastest, most costly something or other "in the world" is a far more potent factor in modern progress in the mechanical arts than we ever suspect. Unquestionably the development of the modern steamship owes as much to the simple desire on the part of the ship builder to beat somebody else, as does the speed of the race horse or the agility of an athlete. This competition for its own sake has seized upon the builders of torpedo boats and driven them so hard that they are raising the limit for speed by leaps and bounds. It was only late last year that the Sokol startled the marine world by passing the 30 knot limit -for years the goal to which the builder of swift craft had looked as a remote possibility—and yet her record was quickly broken by a French torpedo boat. And now the palm has been transferred across the channel again and Her Majestv's ship Desperate stands as the fastest vessel in the world with a record of over 31 knots, or about 36 miles an hour. One would think this was sufficient; but almost before the little craft has had time to tie up at her dock, the British Admiralty is demanding 33 knots an hour in the contracts for her successors. That is about 38 miles an hour; and as these builders have always reeled a knot or two more than the contract speed out of the little fliers, we may look for a spurt of 34 or 35 knots on the trial trip. That would be 40 miles an hour, or fully up to the all-day speed of an average express train!

Such a speed will not be obtained with a horse power much under 8,000. This is one-fourth the trial trip horse power of the Lucania. The Lucania is of 13,000 tons displacement—these craft will probably be of less power to drive her.

#### APPARATUS FOR MEASURING THE SPEED OF PROJECTILES.\*

This new instrument for the reliable measurement of very minute intervals of time was developed in some preliminary experiments at the United States Artillery School, Fortress Monroe, Va., in measuring the velocity of projectiles from the new 3.2 inch B. L. field rifle adopted by the army.

necessarily limited to two weeks' time, observations were taken at intervals as small as 5 feet, and as many as ten consecutive observations at 5 foot intervals, beginning at the muzzle of the gun and extending to 45 feet distance, were easily obtained from a single shot. This instrument being admirably adapted for recording the passage of the projectile at a number of points of its trajectory, it was made an object to study the law of variation of the

velocity of a projectile near the muzzle of a gun. From measure-being crossed, so that no light emerges from the ana-1 current passes only through the screen, X', because of ments on the negatives it is clearly evident from each lyzer, a current is sent through the coil on the tube, that the velocity actually increases after leaving the gun, a fact which has long been suspected, but which. so far as we know, has not previously been demonstrated experimentally.

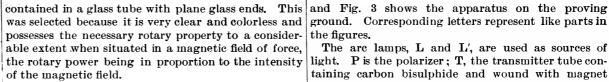
The particular form of transmitter used in these experiments depends for its action upon the use of polarized light. A sensitive photographic plate is made to rotate at a known speed in a light-tight box, and light is admitted to the plate through a narrow slit by means of a "massless" shutter, as the inventor terms it. Any material shutter would possess a certain amount of inertia, and would not admit of a practical result. By the use of a polarizer the light is admitted or shut off without the movement of any material thing.

As is well known, the most efficient polariscope consists of a pair of Nicol prisms. When the prisms are "crossed," the light is totally extinguished, as though the beam had been interrupted by an opaque body. By turning the analyzer ever so little from the "crossed" position, light will pass through it, and its intensity increases until the planes of the prisms are parallel, when it again diminishes, and if one of the prisms is rotated, there will be darkness twice every revolution.

To accomplish the end that is obtained by rotating | Fig. 2.—ARRANGEMENT OF ELECTRICAL CIRCUITS.

the analyzer without actually doing so, a transparent medium which can rotate the plane of polarization is placed between the polarizer and analyzer, and made subject to the control of an electric current. The medium used in these experiments was liquid carbon bisulphide,

\* For the information here given we are indebted to Dr. Albert C. Crehore, Assistant Professor of Physics, Dartmouth College, and Dr. George O. Squier, First Lieutenant, U.S. A., Instructor U.S. Artiltery School.



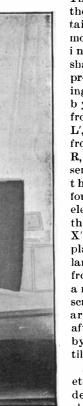
To produce a magnetic field in the carbon bisulphide a coil of wire is wound around the glass tube, and an In the course of these experiments, which were electric current passes through the coil. The prisms motor, M, revolves the sensitive plate in the camera.

ground. Corresponding letters represent like parts in the figures.

The arc lamps, L and L', are used as sources of light. P is the polarizer; T, the transmitter tube containing carbon bisulphide and wound with magnet wire; A is the analyzer, in front of which is a lens to condense a beam of light upon the camera, C. The

> The speed of the plate is obtained at the moment of firing by the shadow of one prong of a tuning fork cast by a beam from the lamp, L', reflected from a mirror. R, upon the sensitive plate, the tuning fork being run electrically by the cells, E. At X',  $X^2$ ,  $X^3$ , etc., placed at regularintervals from the gun, are wire screens which are cut one after the other by the projectile.

At Y', Y2, Y3, etc. are placed devices for mechanically restoring the

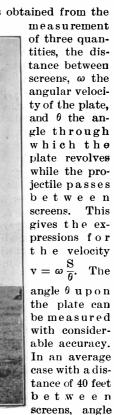


current. Before firing, the an insulating plug placed between the jaws of the device which interrupts the connections between X', X2, X3, etc. When the projectile strikes a wire attached to this insulating plug, the plug is pulled out and the jaws spring together, thus establishing the circuit

through X2. The receiver is a photographic means of recording the intermittent beam of light through the analyzer, and consists of a camera containing a sensitized plate, which is shown in position ready for use at C

The electrical tuning fork is shown at F (Fig. 1). Four storage cells were used to energize the motor, and greater uniformity in speed was obtained by placing a heavy iron-toothed gear wheel as a flywheel on the motor shaft, as shown at N (Fig. 1). This wheel also served another purpose in offering a convenient and ready means of determining the proper speed of rotation for a given setting of the camera slide. The wheel contained 56 teeth, and by simply holding on its periphery the edge of a card, with the motor running at an unknown speed, the corresponding note would be given out, and when this was compared with a tuning fork in the other hand of the observer, it indicated at once whether the speed of the motor should be increased or diminished.

The velocity of the projectile is obtained from the



6 is 108° 0969.

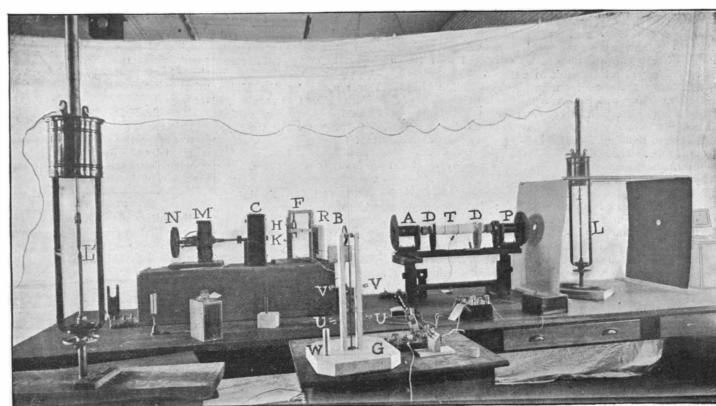
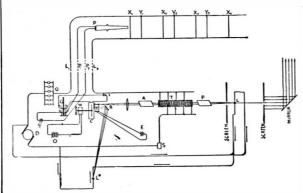


Fig. 1.-ARRANGEMENT OF LABORATORY APPARATUS.

causing the rotation of the plane of polarization.

This is equivalent to rotating the polarizer; hence a light now emerges from the analyzer. When the current is broken the medium loses its retary power and there is again complete darkness. This arrangement makes an effectual shutter for the beam without moving any mass of matter.

A view of the laboratory apparatus is shown in Fig. 1. Fig. 2 shows diagrammatically a complete arrangement of the electrical circuits and apparatus,



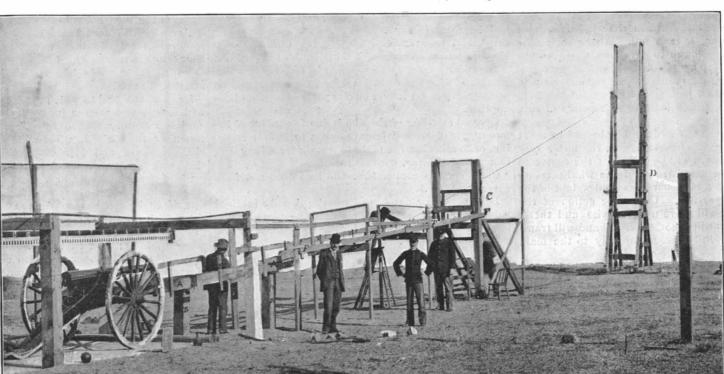


Fig. 3.—APPARATUS FOR RECORDING THE SPEED OF PROJECTILES.

with a probable error from nine measurements of it is surmounted, at two minutes before one is raised 0.0074 or an error of one part in 14,630. The angular velocity  $\omega$  can with proper instruments be obtained with great accuracy.

The principal ballistic result obtained from the experiments may be said to be the locating of a maximum point in the velocity curve outside of the gun. This maximum point is, in the present experiment, at 6 or 7 feet from the muzzle of the gun-certainly more than 5 feet and less than 10—or about 25 calibers in front of the muzzle. The increase in velocity from the muzzle to the maximum point is large, more than 40 foot hill and look at it.

seconds. The muzzie velocity being about 1,600 feet, this increase is about 2.5 per cent of the whole.

The decrease in velocity beyond the maximum point is comparatively gradual, obeying the true law of the resistance of the air, so that the projectile must travel about a hundred feet before the velocity is reduced to that which it actually had at the muzzle.

This maximum point introduces an error in the present method of •btaining muzzle velocities, in which the velocity is measured at a distance of 100 to 200 feet and reduced back to the muzzle by formulas. The Frank-

lin Institute has awarded the John Scott Legacy medal and premium to Lieut. Squier and Prof. Crehore for this apparatus.\*

THE ROYAL OBSERVATORY AND HOW THEY TELL THE TIME AT GREENWICH.

BY DR. D. DUNBAR.

Greenwich, situate on the winding Thames, five miles east-southeast from London, in the County of Kent, possesses a large amount of historical interest. It is the birthplace of many ilustrious persons, among them Henry the Eighth, Edward the Sixth, Queen Mary, Queen Elizabeth, and several children of James the First. But it is not of departed kings and queens we propose now to speak, nor of the social attractions of Greenwich. It is a place of great resort, specially on a bright bank holiday.

The observatory building is familiar to every inhab itant of the town, and well known to scientific men all over the world. It stands on the spot once occupied by the tower built by Duke Humphrey. At one time the observatory was furnished with a deep well for the observation of stars in the daytime, but the great improvement in telescopes rendered this unnecessary, this in popular rather than in scientific language.

and it is now arched over. An apparatus has been erected on the eastern turret of the observatory for the purpose of enabling the captains of vessels leaving the river to ascertain by it the rate of their chronometers, thus obviating the necessity of applying at the observatory. It consists of a large ball of wood lined with leather, which, in order to give preliminary notice, is raised at five minutes before one P. M., half way up a pole, by which

\*This apparatus is described at greater length and with additional illustrations in Supplement, No. 1054.



THE GUIDER AND PHOTOGRAPHER AT WORK.

to the top, and at one o'clock precisely the ball drops. By means of an electric current from the observatory accurate time signals are distributed every hour by the post office telegraphs to a large number of towns, and clocks in the metropolis and country are synchonized. There is in the wall of the observatory a large twentyfour hour clock face, that is, with hours marked from one to twenty-four, to include a day and night; where the time is exhibited at any hour when the park is open for any one who chooses to climb the pleasant



THE ROYAL OBSERVATORY AT GREENWICH.

four apartments. It is a quiet, retired spot well walled large and fine telescope, mounted between two uparound, some 150 feet above the average height of the river. The roar of London sounds muffled and distant, and only seems to emphasize the sense of calmness and silence in this abode of science. Here, above the trees of the old park, and on the rim of the mighty city, the astronomers keep the time for half the world. Greenwich time is the standard for the British nation, for British ships at sea, and for the ships of most other countries as well.

We were received by Mr. W. H. M. Christie, Astronomer Royal, and placed in charge of the senior computor, Mr. H. Furnel, to be escorted over the apartments. We soon find that his acquaintance with the interesting and delicate instruments that are explained in turn is much greater than our limited powers of comprehension. But Mr. Furnel, who has become a student of the stars, is a patient gentleman who goes to much trouble in his endeavors to initiate a layman in the mysteries of the heavens.

The main question of this paper is how they tell the time at Greenwich, and we shall endeavor to explain

The fixing of the standard of time depends on astronomical observations. When the sun is exactly south—on the meridian, as it is called—the hour is twelve o'clock noon. As the movement of the sun apparently fluctuates, astronomers call this apparent noon. At Green wich Observatory to the study of the sun is added that of the stars for accurately recording the time.

The way of it is this. There are two finely made clocks-the solar clock, keeping the solar time, and the sidereal clock, regulated by observations of the stars.

The sidereal clock is kept as the standard, and every

night or day the weather permits, any error is determined by comparison of the clocks. The error of the solar clock is then corrected.

The standard time, therefore, is kept for the nation at Greenwich by constant observation of certain stars, checked by observations of the sun. There are some two hundred and fifty stars calendared at Greenwich, which are known as clock stars. The observations are made with a fine instrument called the transit or meridian circle. Greenwich has the honor of having been the first observatory in the world where a large transit

The observatory is an oblong edifice, divided into circle was mounted, viz., in 1850. Briefly, it is a rights, and pointing exactly to the center line-the meridian—of the heavens, as seen at Greenwich. As the telescope is so hung that it will swing round in a complete circle between the uprights, it can view any point in this center line of the heavens. The roof of the room in which the telescope is placed can be opened by a sliding or trap door above it, and thus can expose any point of the meridian.

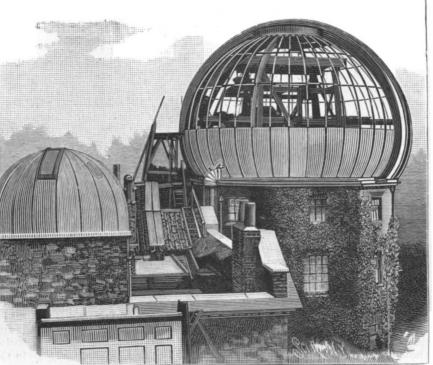
> This center line is supposed to be drawn across the heavens from pole to pole of the earth, through the Greenwich zenith; and it is when on this center line in their journey from east to west that the sun and stars are said to be on the meridian. When the sun is on this line, the hour is midday at Greenwich.

> In the eyepiece of the telescope are five wires, one of which is exactly on the middle. When, therefore, the star passes this line, it is at the highest, or crossing the meridian. This, however, is not exactly the same as the actual time, because no transit telescope is probably exactly on the meridian line, and the error is corrected by various calculations.

Connected by electricity with the transit circle is a

"chronograph," which at Greenwich is on the other side of the courtyard.

The chronograph is a cylinder on which paper is fixed, and on paper is registered the times of the stars'



ONE OF THE DOMES.



TAKING AN OBSERVATION.

also register the seconds of a sidereal clock. By this system of registering the transit of stars greater accuracy is gained and also greater time is permitted to the observer to gaze through the telescope.

But it may still be asked, Why are stars selected to tell the time? Because, for one very potent reason, there is but one sun, and there are so many stars therefore, so many more chances of good observation. There are very few nights on which some of the 250 clock stars used at Greenwich are not observable. Further, the observations on the various stars may be used to check one another and correct errors, while but one observation of the sun on the meridian can be

But how can the passing of the star over the meridian tell the time? In this way: The complete turning round of the earth on its own axis causes a day and night, that is, twenty-four hours, which, in astronomical language, form one day. If, then, a certain star be on the meridian at such a time, it should be on the meridian again, after a lapse of twenty-four hours, at precisely the same time; and the clock, to be accurate, should agree. The earth has made one complete turn round, one complete rotation, and one complete day and night have passed. This is termed a sidereal day. and it is regarded by astronomers as always of the same space of time, because the turning of the earth is regarded as exactly uniform.

The solar day or solar time is measured by the pas sage of the sun day after day across the meridian, and is four minutes more than the sidereal day. Further, the solar day differs somewhat in length, through the movements of sun and earth; thus the earth moves more quickly in winter than in summer; and these differences are allowed for by astronomers in calculating time. The result is what is called "mean" time.

The reason of the difference of four minutes is that one revolution is added to the diurnal revolutions of the earth on its axis, in consequence of its revolution around the sun in its orbit, so that while there are in round numbers 365 days in the solar year, there are ation of the fact that the milk dealer not infrequently 366 sidereal days. The four minutes per day difference, therefore, makes in the year another whole day, that is, 24 hours 20 minutes. Four minutes saved or lost in a day, you see, make up a whole 24 hours at the end of the year.

But the keeping of the time is not the only work that is done at the observatory. There are ten great telescopes, the largest one being nearly 30 feet long, with an object glass of 28 inches. Over this is a beautiful dome, made like the others of papier maché stretched over iron framework. This gives lightness milk, for all of these are produced by the growth of and strength, enabling the dome to be easily worked the bacteria. But these bacteria are of many kinds, on wheels. One portion, opened like a sliding shutter, reveals a strip of sky from the zenith to the horizon; so that by turning the dome round, any part of the sky can be easily and speedily brought under observa-

The large telescope is devoted to the stupendous work of photographing the heavens. About a dozen observatories are engaged in this truly gigantic task, each having a certain portion allotted to it.

All is remarkably quiet at the observatory, Greenwich. Day after day and night after night the observations go forward and the calculations are made. About twenty computers are busily engaged in reducing by calculation the various observations that have been made.

For anything I have been able to say, I am indebted to the astronomer royal and his able assistants; also to those who like myself have visited the royal observatory at Greenwich and made notes, and fers. Their beneficial effects are shown upon at least by comparing notes have been assisted in reaching two important dairy products, butter and cheese. accuracy.

#### Bacteria in Milk.\*

size. So small are they that in some cases 50,000 might souring. During this ripening the cream acquires a stand side by side and the whole line only reach a length of an inch. They are extremely simple also. and others still are of a spiral shape. But although cream. During this twenty-four to forty-eight hours and 88,000,000; Hungary, 63.030.000 and 46,103.000; and of multiplication are so great as to make them factors of profound significance in the processes of nature. So rapidly can they multiply that in some cases a single individual in the course of twenty-four hours may produce nearly twenty million offspring. This be surprised to find them capable of accomplishing by their growth many great changes in nature.

Pure milk, as it is secreted from the udder of the healthy cow, contains no bacteria. If the cow be diseased, this may not be true, but the milk from the healthy cow contains no bacteria when first secreted. Nevertheless, by the time the milk reaches the milk pail it will contain from 30,000 to 5,000,000 bacteria per cubic inch. It is hardly conceivable that the few moments of the milking should be sufficient to contaminate the milk to this extent. We have learned in decidedly unpleasant. But the first products of delin Germany. Those awarded to American exhibitors

ous host.

Part of them, a small part, come from the air; part of them are already in the milk pail. The dairyman never washes his milk pail free from bacteria. Even with the most thorough washing which the pails receive on the ordinary farm the bacteria are not killed, but remain alive, adhering to the cracks in the tin, or in the crevices in the wood. Part of them come from the milker, for he commonly goes to the milking without any special toilet, with his hands not clean, and clothed in the ordinary farm clothes which have become filled with bacteria from numerous sources. But by far the greatest number come from the cow herself. These are not, however, from the interior of the cow, but from her exterior. First, her flanks are always covered with dirt. Frequently they are covered with layers of dried manure, and always the hair of the legs, sides, flanks and tail are covered with a large amount of dust and dirt. All of the dirt and manure is crowded with innumerable hosts of bacteria. Again, the milk ducts of the cow's teats form a prolific breeding place for the bacteria. After each milking some milk is left in the milk ducts, and in this the bacteria which may get to teat from the air or the dirt or hairs of the cow find abundant food. Here they multiply, and by the time of the next milking they are present in countless millions, ready to be washed out with the first milk that is drawn.

From such sources, then, the milk receives its population of bacteria, and these sources are sufficient to inoculate the milk to the great extent mentioned. The great remedy for them is cleanliness. Remembering that the bacteria grow rapidly after getting into the milk and begin to multiply with great rapidity, the value of the immediate application of cold to the milk is plain. The milk when drawn is in just the best possible condition for them to multiply. Immediate and rapid cooling so greatly checks the growth of bacteria as to greatly reduce the number present in the course of twenty-four hours. This is the explanhas complaints from his patrons that his morning's milk sours, while no such complaints are received of the milk of the night before. The latter was cooled during the night, while the former was taken to delivery at once from the cow or with insufficient cooling. For this reason it actually sours quicker than the milk of the night before, which needs to warm up before the bacteria can grow in it rapidly.

If milk contained no bacteria, it would never undergo any of the common changes which are common in and even those that commonly get into milk are of many different species. Certainly over 100 different species of bacteria are common in our milk. But these different species do not all produce the same effects on the milk. Some of them sour it by changing the milk sugar to lactic acid. This, as well known, is the most common effect arising in milk upon standing, but others produce other results. Some of them make the milk bitter; some curdle it, but render it alkaline or sweet to taste; others give it an unpleasant, tainted taste; others, again, render it slimy or ropy; some turn it blue or yellow or red.

We are accustomed to think of bacteria as unmitigated nuisances. We think of them as the causes of disease, and if, perchance, we think of them as connected with dairy matters, it is always as the cause of milk souring or some other milk trouble. But the dairyman really benefits from them more than he suf-

Every one knows that cream is seldom churned when fresh. It is allowed to stand in a vessel or vat for a time and undergoes a process which we call ripening, Bacteria are plants of almost inconceivably minute or which is in some parts of the world simply called pleasantly sour taste and a peculiar pleasant odor. as 2,400,000,000 per cubic inch. This growth produces a fermentation, just as the growth of yeast in the brewery malt produces its fermentation.

The object of this ripening is at least threefold. power of multiplication is so enormous we must not First, it makes the cream churn more readily, and, second, it gives a larger amount of butter from a given lot of cream. The third object is to give flavor to the butter. The explanation of the flavor is simple enough. While the bacteria are growing in the cream they are producing, as they are feeding upon it, certain chemical changes in it. As the result of these chemical changes decomposition products are developed, and expected distribution of Columbian World's Fair diplothese products have various flavors and odors. If the mas and medals has begun. On April 20 a consideraripening is allowed to continue long enough, the whole ble number of diplomas and medals were given to Baron mass becomes decayed and the flavors and tastes are Thielmann, the German ambassador, for distribution \*By Prof. H. W. Conn (of the Biological Department, Wesleyan University), in the Spatula.

\*By Prof. H. W. Conn (of the Biological Department, Wesleyan University), in the Spatula.

\*By Prof. H. W. Conn (of the Biological Department, Wesleyan University), in the Spatula. agreeable, and it is these which give flavor to the sively long delay is to be deeply regretted,

transit across the fine lines of the telescope. It can the last few years, however, the sources of this numer- cream and to the subsequent butter. After they have developed in the cream, the churning simply separates the butter already flavored with these products. Thus the flavor and aroma of a first class butter are the gifts to the butter maker from the bacteria of the ripening period.

> To make good butter, the butter maker needs not only the freedom from the species of bacteria which produce unpleasant flavors, but he needs also the presence of the species which produce the desired flavors. Butter made from cream that comes from the cleanly kept dairy may be depended upon not to develop the unpleasant flavors which arise in butter of cream from the filthy dairy and barn.

> But to insure the proper number of proper flavorproducing species simple cleanliness is not so much to be depended upon. In many such cases it is true the proper flavor-producing species will be present, but not always. But why is it not possible to directly inoculate the cream with the proper flavor-producing species, just as the brewer inoculates his malt with yeast? This does, indeed, appear not only to be possible but perfectly feasible, and it involves the use of what are now known as starters. The starter is simply a lot of cream or milk containing a large number of bacteria, which is poured into the cream to be ripened to start the proper kind of fermentation. The starters are of two kinds. Natural starters, which are easily made by any butter maker, and artificial starters, which are made upon a different plan. Our bacteriologists, both of this country and Europe, have been searching for proper flavor-producing species, and having found them, they propose to furnish them in quantity to the butter maker for use in his cream ripening. In the use of these starters the species of bacteria furnished by the bacteriologist is allowed to grow in a small lot of cream until its species is very abundant and then the cream is added to the large vat as a starter. The result is that the butter maker can always depend upon having present a quantity of the proper flavor producing species, and can, therefore, depend with more certainty upon the product. This method of using artificial starters is not new. It has been adopted in Denmark and some other countries of Europe to a wide extent. In this country it has been used only for about a year, and is only just coming to be recognized as a proper method of butter making. The bacteria favorable for this purpose are now upon our markets, two or three different ones being now used in this country. They are generally known as pure cultures, a term which simply means a large quantity of one species of bacteria unmixed with

> The bacteria are even more needed in cheese making than in butter making. A fresh, flat, curdy taste is seen in fresh cheese. The cheese to be marketable must be set aside for a few weeks to ripen, and during the ripening the flavors develop. This ripening again is simply a fermentation. It is a fermentation of a different character from that of cream ripening. It takes place more slowly and the products are of a different nature, but it is none the less due to the growth of bacteria, and the different flavors of different cheeses are due to the growth of different kinds of bacteria in the cheese. But the problem has proved a difficult one to handle, and while the general facts are easily made out and are demonstrated beyond question, very little in the way of practical results has as yet been reached. A future in this line can hardly be questioned.

#### The World's Wine Production.

The Moniteur Vinicole has recently published a statement showing the wine production of the various countries of the world. From this statement it appears the yield in France amounted in the years 1895 and 1894 to 587,127,000 gallons and 859,162,000 gallons respectively; in Algeria to 83,549,000 and 80,124,000 gallons; Tunis, 3,956,000 and 3,936.000; Italy, 469,555,000 and 539,000,000; Spain, 379,500,000 and 528,000,000; This ripening is nothing more than a fermentation Portugal, 43,890,000 and 33,000,000; Azores, Canaries, Some of them are simple balls, others are short ones due to the growth of the bacteria which are in the and Madeira, 4,620,000 and 2,640,000; Austria, 66,000 000 thus very small and simple in structure, their powers the bacteria which were in the cream multiply rapidly, Germany, 80,190,000 and 110,000,000 gallons. In Turuntil at the close of the ripening there may be as many key and Cyprus the production last year amounted to 52,800,000 gallons, and this compares with an average yield of 40,000,000 gallons. In Bulgaria the yield was 26,400,000 gallons; Servia, 17,600,000; Greece, 35,200,-000; Roumania, 68.640 000; Switzerland, 27,500,000; the United States, 89,700,000; Mexico, 1,980,000; Argentine Republic, 29,700 000; Chile, 33,000,000; Brazil, 7,700.000; Cape of Good Hope, 2,420,000; Persia, 594,000; and Australia, 3,300,000 gallons.

#### The World's Fair Awards.

Many of our readers will be glad to know that the long

#### Largest and Smallest Books.

Prof. Max Muller, of Oxford, in a recent lecture, has called attention to the largest book in the world, the wonderful "Kuth Daw." It consists of 729 parts in the shape of white marble plates, covered with inscriptions, each plate built over with a temple of brick. It is found near the old priest city of Mandalay, in Burma, and this temple city of more than seven hundred pagodas virtually makes up this monster book, the religious codex of the Buddhists. In accordance with the three parts of which it is composed, generally called in a figurative sense "baskets" (pitaka), the whole is often termed "the three baskets" (tripitaka), and constitutes a library larger than the Bible and the Koran together. As the Jews figured out that the Old Testament contained 59,493 words and 2,728,100 letters, so the Buddhist priests have computed that the "Tripitaka" contains 275,250 stanzas and 8,808,000 syllables. This monster book is written in Pali. Rather strange to say, it is not an ancient production, but its preparation was prompted by the Buddhistic piety of this century. It was erected in 1857 by the command of Mindomin, the second of the last kings of Burma. As the influence of the tropical climate has already marred the inscriptions, a British official, Mr. Ferrars, proposes to have these 729 plates carefully photographed, and asked that the government, or some friend of science able to do so, make provisions for this. Prof. Muller urges that this be done in order to preserve at least the pictures of this unique templecity book.

A noteworthy contrast is furnished by a recent German literary journal describing what is probably the smallest book in the world. This is a "Konversationslexikon," published in Berlin, and prepared by Daniel Sanders. The volume occupies the space of only six cubic centimeters (0.366 cubic inch), although it is claimed to contain 175,000 words. The book must be read through a microscope especially prepared for it.-Mining and Scientific Press.

#### ENGLAND AND THE SOUDAN.

For the accompanying pictures of Soudanese women and warriors, reproduced from photographs by Dr. Jousseaume, we are indebted to Le Monde Illustré. The Soudan includes, in a general way, all the territory south of Nubia and the present British possessions in Egypt to the equatorial lakes, and from the Red Sea on the east to the desert on the west. It is estimated to have a population of from five to seven millions, and is ruled over by the Mahdi, whose seat of government is at Omdurman, and whose lieutenant. Osman Digna, has made frequent raids into the English territories in upper Egypt. To strengthen and possibly advance their frontier, a British expedition of some 9,000 native Egyptian troops, and a contingent of British soldiers, is now advancing up the Nile, although it is not expected that the most serious part of the campaign will begin until September or October, when the rise of the Nile will permit the carrying of supplies for the troops up the river in boats. It is said the dervishes all the time have some fifty thousand men under arms—a force which they could vastly increase without trouble, did mere numbers seem de-

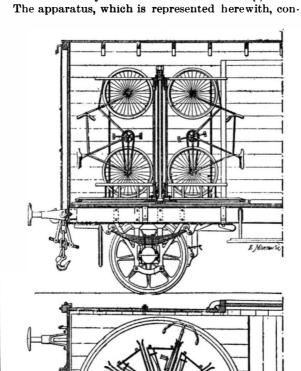
among the tribes of the Soudan are reported to be thinning out the population.

H. Moissan describes two new metallic borides, says the Comptes Rendus, obtained at a  $temperature \bullet f$ 1,200° C., nickel boride, NiBo, and cobalt boride, CoBo. Both occur in brilliant prisms several millimeters in length and are magnetic. Their densities at 18° are about the samenickel boride, 7.39; cobalt boride, 7.25. The properties of the borides are analogous to those of iron boride, and the compounds

as iron when at a high temperature. It has been demonstrated that both boron and silicon can displace the carbon in molten iron when added in suitable

#### THE CARRIAGE OF BICYCLES BY RAILWAY.

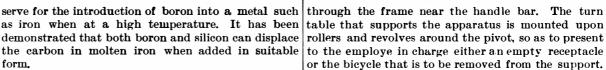
Among the numerous systems of carrying bicycles by railway, now proposed or put into practice, one of the most ingenious is certainly that devised by Mr. J. Oller, and which is at present on exhibition at the third Salon du Cycle at the Palace of Industry, Paris.



APPARATUS FOR THE CARRIAGE OF BICYCLES ON RAILWAYS-ELEVATION AND PLAN.

sists essentially of a turn table capable of receiving ten bicycles arranged vertically around a central pivot from which they radiate and are held in place by two series of forks, which embrace, respectively, the fore wheel above and the hind wheel below. One of the branches of the fork is stationary, while the other, monnted upon springs, is capable of receding from the first through the pressure of the pneumatic tire, which the springs hold in place in such a way as to prevent sirable. Famine, disease, the slave trade, and war any tossing about. As a further measure of precau-

tion, the bicycle is held



The bicycles thus stowed away are perfectly independent, and well arranged for easy approach when the time comes for putting them off the car. An ordinary baggage car is capable of receiving two of these movable apparatus, say twenty bicycles, and yet leave a free space between them for two bicycles or two tandems. These apparatus may also be placed upon trucks or open cars during fine weather, when a crowd of bicyclists is anticipated upon a line on a holiday.

The same arrangement, mounted upon an ordinary truck, will furnish the ideal vehicle for a system of bicycle transportation analogous to that used in large cities for the carriage of pianos. A special truckman with this apparatus will be able to deliver unpacked bicycles either to private parties, on the account of railway companies or of cycle manufacturers, or to railway stations.

We do not dare to assert that the apparatus under consideration affords a complete solution of the problem of stowing away bicycles upon cars, says La Nature, but, with the present form of machines and their handle bars, we know of none more simple and practical.

#### Intoxicated Wasps.

Concerning his observations of wasps which are addicted to the use of intoxicating liquors, Lawson Tait relates the following:

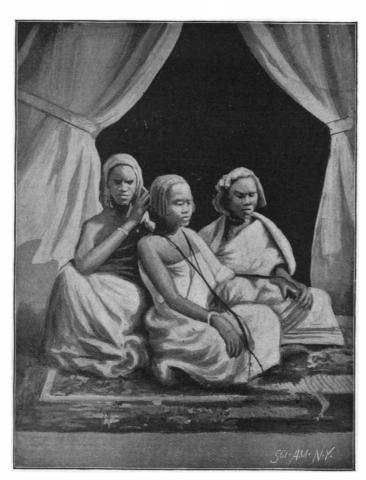
"I have been watching the wasps with great interest and have noticed the avidity with which they attack certain fruit when fully ripe, rotting in fact, and I have also noticed some of the peculiar results of their doing so. The sugar in some fruits which are most attacked by wasps has a tendency to pass into a kind or kinds of alcohol in the ordinary process of rotting, a fact which is easily ascertained by the use of a still not large enough to attract the attention of the excise authorities. On such fruits, particularly grapes and certain plums, you will see wasps pushing and fighting in numbers much larger than can be accommodated, and you will see them get very drunk, crawl away in a semi-somnolent condition, and repose in the grass for some time, till they get over the 'bout,' and then they will go at it again. It is while they are thus affected that they do their worst stinging, both in the virulent nature of the stroke and the utterly unprovoked assaults of which they are guilty. I was stung last year by a drunken wasp, and suffered severely from symptoms of nerve poison for several days. In such drunken peculiarities they resemble their human contemporaries."-Registered Pharma-

#### Niagara's Power Transmitted to New York.

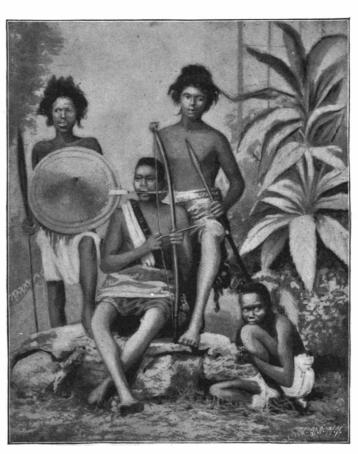
A model of Niagara River, the power house, the town and the discharge tunnel will be exhibited at the National Electrical Exposition to be held in New York in May. The model is 12 feet by 4. The turbines will be run for a time each evening with electricity generated at Niagara Falls and transmitted to New York by two copper wires of the Western Union Telegraph by a strap that passes Company. Telephones will be connected with instru-

ments at Niagara, so that the roar of the falls may be heard. It is also said that some steps are being taken to deliver some of the current to condensers connected with an Atlantic cable, so that the power of Niagara may be transmitted to Europe.

DR. HOLDEN, of the Lick Observatory, has received the decoration of the Order of Bolivar (of Venezuela) for his disservices to science. He has previously received the decoration of commander of the Ernestine Order of Saxony.



TYPES OF WOMEN AT KHARTOUM.



SOUDANESE WARRIORS.

#### Business and Personal.

The charge for Insertion under this head is One Dollar a lin for each insertion; about eight words to a line. Adver tisements must be received at vublication office as early as Thursday morning to appear in the following week's issue

Marine Iron Works. Chicago. Catalogue free. "C. S." metal polish. Indianapolis. Samples free. Mariner & Hoskins, Assayers, 81 Clark St., Chicago. W. Hoskins & Co., Assay Furnaces, 81 Clark St., Chicago. Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J. Handle & Spoke Mchy. Ober Lathe Co, Chagrin Falls, O Send for cat, and sample copy. Open Court Pub. Co.

Screw machines, milling macnines, and drill press The Garvin Mach. Co., Laight and Canal Sts., New York. Wanted-Competent foreman for manufacturing sheet and wire specialties. Address "Enterprise," Box 773, N. Y.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins By mail. \$4, Munn & Co., publishers, 361 Broadway, N. Y.

Stay with your job, and with your wages pay installments for a profitable olive orchard. Booklet free. Whiting's Olive Colony, Byrne Building, Los Angeles,

Concrete Contractors-Make more money by extending your business. Investigate Ransome's Concrete Liberal terms for exclusive rights. Ransome & Smith Co., 622 Boylston Bldg., Chicago.

Wanted.-Copies to complete files of the following Revolutionary magazines: Massachusetts Magazine, New York Magazine, Royal American Magazine, Columbia Magazine. State price, and whether perfect or not Address M. A. C., Box 773, New York.

Cripple Creek-Its History to Date, Illustrated .- Just out, with correct map and costly full page views of mines natural as life. This great book will be sent free prepaid with our big 56-col. family paper 3 months on trial for 25c. (stamps or silver); club of 5, \$1. Latest mining news. Mention the SCIENTIFIC AMERICAN and address Illustrated Weekly, Denver, Colo.

Tersend for new and complete catalogue of Scientific and other Books for sale by Munn & Co.. 361 Broadway New York. Free on application.

#### RECENTLY PATENTED INVENTIONS. Engineering.

LOCOMOTIVE TRUCK SPRING HANGER. -Charles Linstrom, Vicksburg, Miss. This hanger has two forks for engagement with the pivots of equalizing bars, the inner members of the forks being rigidly connected with each other, and the forks being adapted to receive the equalizing bars. Each leaf spring extends between two equalizing bars on each side of the truck, and the seat in each hanger is at the center, so that the loadis well distributed, and it is not possible to force the springs out of their proper position by heavy shocks or

#### Railway Appliances.

CAR COUPLING.—Frederick D. Crandall, Sturgeon Bay, Wis. This invention relates to improvements in car couplings of the rotary head type have ing thin jaws, the coupling being adapted to couple automatically with another similar coupling whether the drawheads are aligned with each other or not, while the uncoupling may be readily effected from either side of the car. The improvement may also be used to couple with cars having the ordinary link and pin coupling.

#### Electrical.

TELEPHONE BELL.—Richard D. Harrigan, Leadville, Col. This invention provides a simple and quick-acting device whereby the bell will continue to be sounded after the main circuit shall have been opened or cut out, at the main office or elsewhere, and also to ring a bell at a distance from the telephone. An auxiliary circuit is provided, which may be omitted or employed alone, the main object being to set a bell in operation after the first ringing of the telephone bell

ELECTRIC SWITCH.—Charles G. Bergquist, Chicago, Ill. This is a simple and compact device for attachment to electric fixtures, having the appearance of a gas key, and adapted to turn the electricity on or off as one turns a gas key. An insulated switch arm is carried by a revoluble tubular shaft, two contacts receiving the vires, a ratchet wheel being attached to the tubular shaft and a pawl attached to the support engaging the teeth of the ratchet wheel. A spherical casing is held around the switch by caps screwel into its body, a key passing into the casing screwing into the tubular shaft of the switch.

ELECTRICAL HAIR CUTTER AND SINGER.—Frank M. Bell, New York City. An electrically heated wire or bar, according to this improvement, is practically utilized for cutting and singeing the hair. In a comb provided with a handle are insulated electric conductors, and there are adjustable studs in the comb and comb handle between which is strained a wire or bar of platinum or other refractory material, there being also electrical connections and a button for closing and breaking the circuit. By pressing the button the circuit is completed through the wire, heating it sufficiently to burn the bair in contact with it.

#### Mechanical.

SHEET METAL GAGE.-Elbridge G. Paull, Fairhaven, Mass. This improvement comprises a rigid or main frame part with jaw, an upright and a lever handle, a compound lever consisting of a jaw with tappet arm and a handle connected together by a spring, and pivoted within the rigid or main frame part, while a pivoted index hand is acted upon by a tappet arm, there being a circular graduated scale, and a spring throwing the lever handles apart. Variations in the hand pressure on the levers make no appreciable difference in the bite or pinch of the jaws, and the gage enables measures to be taken with great exactness and uniformity.

Call, electric guest. S. K. Gimbel.

Call body forming, soldering and heading machine, O. T. Holbrook.



#### HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Ninerals sent for examination should be distinctly

price.

Minerals sent for examination should be distinctly marked or labeled.

(6841) H. De W. asks: 1. What kind of steel should be used to make a permanent magnet? Please give commercial name of steel. A. Tool steel of good quality. 2. To what degree of hardness should the steel be tempered, so that it will retain the magnetism? Should the heating be done by coal, wood or other fire? A. Straw color in a clear fire. 3. What is the best means of magnetizing the steel, to give it the strongest mag netic effect? A. By a magnetizing coil moved from end to end 4. Will plating with gold, silver, or nickel diminish the attracting or "sticking" of the magnets? A. Almost imperceptibly. 5. Would the application of "mannocitin" lessen the attracting power or adhesion of the magnets? A. Almost imperceptibly, if thin. 6. Will the strength of permanent magnets be impaired by constant contact with the human body? A. No. 7. Do the variations of temperature have any effect upon permanent magnets, and if so, what? A. Increase of temperature tends to lower intensity. There is a certain amount of "trade secrets" involved in the making of magnets. When a particular brand of steel is found best, it is often not disclosed. Information on making perma nent magnets will be found in Scientific American Supplement, No. 318, and information on the effect of temperature on same in Scientific American, No. 4. Very exhaustive articles on magnetism, the construction of magnets and electro-magnets, their physics, etc., will be found in Supplement, Nos. 777, 778, 779, 780, 781, 784, 785, 786, 787, 788 and 789.

(6842) J. L. asks how to braze a band aw. A. Scarf the saw ends to match with a lap of 1/4 inch, for small saws, up to 3/4 inch, for large size. The scarf should not be brought to a sharp edge; it is liable to burn. Bind together with fine iron binding wire, with the laps wet with a paste of borax and water ground on a piece of slate or rough glass. Pin the blade, laid straight, on a large piece of charcoal, ground flat, with a reces excavated under the scarf so as to allow a blowpipe flame to pass under the saw blade. Place a piece of brass or, preferably, silver solder or coin on the upper edge of the lap, with enough ground borax to flow the brazing Heat with a blowpipe under and above the blade until the solder flows, when it will draw entirely through the lap. When cold, file to an even thickness

### INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

April 21, 1896,

#### AND EACH BEARING THAT DATE.

[See note at end of list about copies of these pate	nts.]
	558,863 558,625
Advertising purposes, stereoscope for, R. Hari-	,
Air brake system, J. H. Brookmire, Jr	558,694 558,670
Air drying device, A. M. Purves	558,840
	558,564
Klimmer	558,818
Klimmer. Aluminum, producing hydrous chlorid of, F. A. Gooch	558.726
Axle box, railway carriage, J. Korbuly	558,745 558,693
Baby jumper, J. A. Eshbach	558,792
Baling press, M. I. Tuttle	558,624
Band cutter and feeder, W. W. Dingee	558,873
Barlin, See Hot air bath. Vapor bath. Bearing, ball, H. Lanius Bed bottom, pneumatic, J. Gimbel Belt and garment holder, F. O. Brown Beverages, apparatus for carbonating and dispensing, P. E. Malmstrom Bicycle, G. Seyfang Bicycle basket carrier, L. S. Manning Bicycle basket carrier, I. S. Manning	558,732
Belt and garment holder, F. O. Brown	558,771
Beverages, apparatus for carbonating and dis-	550.040
Bicycle G. Seyfang	558 852
Bicycle attachment. J. C. Garvey	558,681
Bicycle basket carrier, L. S. Manning	558,879
Bicycle fitting, J. G. Ziegler.	558,545
Bicycle lantern bracket. G. F. Woodman	558,669
Bicycle nock. H. T. Adams	558.837
Bicycle rest, adjustable, F. Kam	558,815
Bilge water discharging apparatus. N. Power	558.912
Bicycle lantern bracket. G. F. Woodman. Bicycle pump, L. N. Petitpain. Bicycle pump, L. N. Petitpain. Bicycle rest, adjustable. F. Kam Bicycle saddle, F. E. Granger. Bilge water discharging apparatus, N. Power. Billiard cushion, pneumatic, H. A. Bierley. Bill. See Check bit. Bicking box. J. T. Smith. Body snield, E. Hunt. Boiler. See Steam boiler. Water tube boiler. Boiler drums, steam extractor for, J. J. Hogan. Boiler tube extension coupling, J. J. Hogan. Book, duplicate memorandur or sales check, W.	558,892
Blacking bo x. J. T. Smith	558,853 558,812
Boiler. See Steam boiler. Water tube boiler.	
Boiler drums, steam extractor for, J. J. Hogan	558,906
Boiler tube extension coupling. J. J. Hogan	558,905
Book, duplicate memorandum or sales check, W. A. Cooke Jr.	558,637
Book, manifold memorandum, E. W. Blackhail.	558,712
	558,636
folding, W. A. Cooke, Jr	558,635
Bosh plate, D. Fox	558.903 558,596
Bottle, A. Rosedale	558,523
Bettle capping machine, J. E. M. Becker	558.760
Bottle, mucilage, J. H. Hollen	558,607 558,543
Bottle stopper. W. J. Cunningham 558,722,	558,543 558,782 558,505
Books, transter sheet holder and cover for manifolding, W. A. Cooke, Jr. Bosh plate, D. Fox Bottle, McKiniry & Von Bokern. Bottle, A. Roseda!e. Bottle, apping machine, J. E. M. Becker. Bottle, mucilage, J. H. Hollen. Bottle, mucilage, E. K. Williams. Bottle stopper, W. J. Cunningham. 558,722, Bottle washer, Maslin & McHugh. Bottles for sterilizing purposes, closure of, J. Schafer	
Box. See Axle box. Blacking box. Car sanding	558,848
box. Brake. See Car brake.	
Brake beam fulcrum post, H. B. Robischung	558,521 558,899
Brushes, manufacture of, J. Stauder	558.855
Brake beam fulcrum post, H. B. Robischung Brake handle cap, J. De Moulin. Brusbes, manufacture of, J. Stauder. Burglar slarm, capsizing, O. T. Welch. Burner, See Gas burner track for C. Williger	558,855 558,886
Calculating machine, O Steiger	558,913
Call electric runet C. V. Cimbel	558,773

Can opener, J. P. Anderson Candle holder, E. Gilbert et al. Cane mill, D. G. Coppin	558,540 558,800
Cane mill, D G. Coppin	558,63
Car and track railway, H. G. Wesemann	558,82 558,540 558,898
andie folder, E. Gilbert et al. Jane mill, D G. Coppin. Jane strip and apparatus for preparing it, reinforced, H. B. Morris. Jar and track railway, H. G. Wesemann. Jar brake, J. A. Criswell. Jar brake operating mechanism, E. E. La Rose. Jar coupling, D. J. Stevenson. Jar coupling, H. G. Wesemann. Jar door, A. G. Bierbach Jar, electric railway, H. P. Wellman.	558,58 558,62 558,57
Car door, A. G. Bierbach Car, electric railway, H. P. Wellman Car fender, W. Batten Car fender, W. Everdell	558,474 558,870
Car fender, W. Batten. Car fender, W. Everdell. Car fender, S. W. Neall. Car fender, W. Waegel	558,793 558,833
Car fender, W. Waegel	558,53 558,61 558,65
Car motor, electric street, S. Harris.  Car sanding box, G. D. Hiscox.	558,491 558,680
Carriage curtain fastener, B. J. Aurand	558,70
Cash register indicating mechanism, A. White Caster, F. F. J. Brock	558,88' 558,720 558,668
Chair. See Rocking chair. Chair seat and fabric therefor, E. Morris	558,51
Dar fender, S. W. Neall.  Zar fender, W. Waegel.  Zar, hand, W. H. Saladee.  Zar life guard, street, G. A. Parmenter.  Zar motor, electric street, S. Harris.  Zar sanding box, G. D. Hiscox.  Zar wheel shifter, E. E. Taylor.  Zarriage curtain fastener, B. J. Aurand.  Zase. See Shipping case.  Zash register indicating mechanism, A. White  Zaster, F. F. J. Brock.  Zaster, F. F. J. Brock.  Zastrating instrument, J. Sparenburg.  Dair. See Rocking chair.  Chair seat and fabrictherefor, E. Morris.  Check bit, E. B. Reynolds.  Chutes for ore docks, counterbalance for, E. C.  Carter.	558,74 558,77
Cigar tip cutter. I. C. C. Rinebart	558,61
Ligarette cutting device for continuous cigarette machines, R. Hardie	558,64 558,51 558,65
Clasp, C. Linkenbach Clipping machine, animal, H. Drysdale Closure, A. S. Lambert. Cloth cutting machine, H. Nack	558,82 558,64 658,87
Cloth outting machine, H. Nack	558,83 558,80 558,54
Cloth winding and measuring machine, I. P. Cad- man	558,89
Coach step, C. E. Berger	558,76 558,70
man Clutch, friction. King & Barnbart. Coach step, C. E. Berrer. Cock, sea, P. T. Perkins. Coffe pot, etc. R. Parker. Coffin handle, W. A. Chapman. Cone shaped tightening appliance, D. A. Schrop-	558,51 558,89
pel. Contact switch, multiple, E. H. Wright	558,74 558,75 558,77
Cooker, steam, A. N. Rooks	558,84
welding, G. D. Burton Copying book attachment, J. W. Twyman Cotton thinner and cultivator, combined. R. J.	558,48 558,88
Coupling. See Car coupling. Steam coupling.	<b>558,6</b> 8
Crank or the like, B. Pedersen	<b>55</b> 8.51
Crusher.         See Ore crusher.           Cultivator.         C. P. Lee.           Curling iron, Thomas & Gorton         .558,533,           Cutter.         See Band cutter.	558,50 558,86
Rrowno Sparts, ball bearing for, A. W.	558,77
Diamond polishing tool, E. & R. Loesser Diamond polishing tool, R. & E. Loesser Die press, J. D. Colomy	558,90 558,73 558,60
Dipper, J. Marbury	558,50 558,77
Door, flexible, A. S. Spaulding	558,57 558,70
Door hanger. A. D. Sinex. Double shell tube, W. 'T. Mersereau Dredging and excavating apparatus, G. H. Brey-	558,66 558,65
Drier. See Grain drier. Paper drier.	558,76
Drill. See Seed drill. Drilling machine, A. W. Kinney Driving device, reversing, F. H. Richards	558.49 558,66 558,61
Driving device, reversing, F. H. Richards.  Dye, brown azo, C. Rudolph.  Dye, oxyquinolin azo, C. Rudolph.  Dyes in fabrics, fixing, H. L. Brevoort.  Eyth device and reversering A.S.	558,61 558,71
Earth, etc., collecting and transporting, A.S. Hallidie Electric currents, means for controlling, P. Ken-	558,64
nedy  Electric metering system, J. W. Gibboney  Electric motor regulator. O. H. Pieper	558,65 558,58 558,51
Electric switch operating apparatus, Hinchliffe &	558,68
Electrodes for secondary batteries, manufactur- ing, I. Kitsee	. 558,69
Electrolier, A. Heck. Electrolier, drop light, G. Peeples Electromagnet core A. G. Waterhouse. Elevator. See Portable elevator.	. 558,90 . 558,60 . 558,50
Engine. See Gas engine. Wind and water en-	558,8
gine. Envelope fastener, O. A. Logan Envelope machine, J. Dennig et al	. 558.77
Ethyl Chlorid receptacle, J. Bengue	. 558,79 . 558,69 . 558.5
Fence machine, J. A. Park, Fence machine, wire and picket, J. W. Martin. Fence making tool, T. J. Andre. Fences stay, wire, J. E. Turner Fencing, machine for making wire, W. Edenborr Fender. See Car fender. File for letters etc. F. Muller.	. 558,4 . 558,5
Fencing, machine for making wire, W. Edenborn Fender. See Car fender. File for letters, etc., F. Muller	1 558,7 . 558,6
Filter, J. Davis. Fire extinguisher, W. Esty. Fire extinguisher, A. E. Shober.	. 558,4 . 558.9
Miller Miller	. 558,6
Fire lighter. J. T. McDowell	. 558,5 . 558,5 . 558,8
Klue seraner H Olimanna	558 7
Furnace. See Boiler furnace. Furnace, T. A. McKibbin. Furnace or heater, N. A. Boynton Furnaces, apparatus forcontrolling admission of	558,8
air to, G. R. House Furniture base J. L. Stair	
Kurniture collansible W. H. Vaughan	r . 558,4 . 558,8 . 558,8
Furniture, collapsible, W. H. Vaughan Furnow opening or closing mechanism. C. E. Stewart	. 558,4 . 558,8 . 558,8 . 558,5
Furniture, collapsible, W. H. Vaughan	. 558,4 . 558,8 . 558,8 . 558,5
Furniture, collapsible, W. H. Vaughan.  Furrow opening or closing mechanism. C. E. Stewart.  Game illustrating apparatus, base ball, A. K. Schaap.  Game indicator, E. Brooks, Jr.  Gas, apparatus for generating and storing acetylene, O. T. de Stephardt.  Gas, apparatus for manufacturing, Bosselaar & Gas, apparatus for manufacturing, Bosselaar	. 558,4 . 558,8 . 568,8 . 558,5 . 558,5 . 558,5
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety. lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Eishout. Gas burner, F. R. Fennessy. Gas burner, P. Rohrhach.	. 558,4 . 558,8 . 558,8 . 558,5 . 558,5 . 558,7 . 558,7 . 558,7 . 558,7
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Gas, apparatus for generating and storing acetylene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Eishout. Gas burner, F. R. Fennessy. Gas burner, F. Rohrbach. Gas engine or motor, electrically controlled, Gas engine or motor, electrically controlled, G	. 558,4 . 558,8 . 558,6 . 558,5 . 558,5 . 558,7 . 558,7 . 558,7 . 558,7
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Gas, apparatus for generating and storing acety, lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Eishout. Gas burner, F. R. Fennessy. Gas burner, F. R. Fennessy. Gas burner, P. Rohrbach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Pierson. Gate lock, G. L. Burrows, Jr.	. 558,4 . 558,8 . 558,6 . 558,5 . 558,5 . 558,7 . 558,7 . 558,7 . 558,7
Furniture, collapsible, W. H. Vaughan. Furrow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety. lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Eishout. Gas burner, F. R. Fennessy. Gas burner, P. Rohrbach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Plerson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glass finishing apparatus, S. G. Vogeley.	. 558,4 . 558,8 . 558,6 . 558,5 . 558,5 . 558,7 . 558,7 . 558,7 . 558,7 . 558,7 . 558,7
Furniture, collapsible, W. H. Vaughan. Furrow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety. lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Eishout. Gas burner, F. R. Fennessy. Gas burner, P. Rohrbach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Plerson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glass finishing apparatus, S. G. Vogeley.	. 558,4 . 558,8 . 558,6 . 558,5 . 558,7 . 558,7 . 558,7 . 558,7 . 558,7 . 558,7 . 558,6 . 558,6 . 558,5
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Gas, apparatus for generating and storing acety lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Eishout. Gas burner, F. R. Fennessy. Gas burner, F. R. Fennessy. Gas burner, F. Rohrbach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Plerson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glass finishing machine, S. G. Vogeley. Glove, D. L. Engel. Glove fastener, G. E. Adams.	558,4 558,8 558,5 558,5 558,5 558,5 558,7 558,7 558,7 558,5 558,5 558,5 558,5 558,5
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety, lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Elshout. Gas burner, P. Robrobach. Gas burner, P. Robrobach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Pierson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Glove fastener, G. E. Adams. Governor. feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, sickle, B. C. Rockwell. Gun, air, J. C. Raymond.	. 558,4 . 558,8 . 568,8 . 558,5 . 558,5 . 558,5 . 558,7 . 558,7 . 558,7 . 558,6 . 558,6 . 558,6 . 558,6 . 558,6 . 558,6 . 558,6 . 558,6
Furniture, collapsible, W. H. Vaughan. Furrow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety. lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Eishout. Gas burner, F. R. Fennessy. Gas burner, P. Rohrbach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Pierson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Governor, feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, sickle, B. C. Rockwell. Grinder, sickle, B. C. Rockwell. Gun, air, J. C. Raymondd Hair pin, J. Berkey. Hamefastener, J. G. Miller. Hame fastener, J. Pulley	558.4 558.8 558.8 558.8 558.5 558.5 558.5 558.5 558.5 558.5 558.5 558.5 558.5 558.6 558.6 558.6 558.6 558.6
Furniture, collapsible, W. H. Vaughan. Furrow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety. lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Eishout. Gas burner, F. R. Fennessy. Gas burner, P. Rohrbach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Pierson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Governor, feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, sickle, B. C. Rockwell. Grinder, sickle, B. C. Rockwell. Gun, air, J. C. Raymondd Hair pin, J. Berkey. Hamefastener, J. G. Miller. Hame fastener, J. Pulley	558.4 558.8 558.8 558.8 558.5 558.5 558.5 558.5 558.5 558.5 558.5 558.5 558.5 558.6 558.6 558.6 558.6 558.6
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety. lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Elshout. Gas burner, P. Robribach. Gas burner, P. Robribach. Gas burner, P. Robribach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Pierson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Glove fastener, G. E. Adams. Governor. feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, sickle, B. C. Rockwell. Gun, air, J. C. Raymond. Hair pin, J. Berkey. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Harrow tooth, J. Beaty, Jr. Harvester, fodder, A. W. Addington. Hat finishing lathe, J. B. Howe. Hat rins, etc., rotary cutter for cutting or trim ming edges of, Giddings & Swain. Hav Derss. C. A. Anderson.	588,4 568,5 568,5 568,5 568,5 568,5 568,7 568,7 568,7 568,6
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety lene, O. T. de Sleghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Elshout. Gas burner, P. Robribach. Gas burner, P. Robribach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Plerson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Glove, G. E. Adams. Governor. feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, sickle, B. C. Rockwell. Gun, air, J. C. Raymond. Hair pin, J. Berkey. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Harrow tooth, J. Beaty, Jr. Harvester, fodder, A. W. Addington. Hat finishing lathe, J. B. Howe. Hat rins, etc., rotary cutter for cutting or trim ming edges of, Giddings & Swain.	588,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,6
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety lene, O. T. de Sleghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Elshout. Gas burner, P. Robribach. Gas burner, P. Robribach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Plerson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Glove, G. E. Adams. Governor. feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, sickle, B. C. Rockwell. Gun, air, J. C. Raymond. Hair pin, J. Berkey. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Harrow tooth, J. Beaty, Jr. Harvester, fodder, A. W. Addington. Hat finishing lathe, J. B. Howe. Hat rins, etc., rotary cutter for cutting or trim ming edges of, Giddings & Swain.	588,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,5 558,6
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Eishout. Gas burner, F. R. Fennessy. Gas burner, P. Rohrbach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Plerson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Glove, G. L. Eurows, Jr. Generator. G. E. Adams Governor. Feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, siskle, B. C. Rockwell. Gun, air, J. C. Raymond. Hair pin, J. Berkey Hammock, T. Nesom. Harrow tooth. Beaty, Jr. Har	588,4 558,8 558,8 558,5
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety. lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Elshout. Gas burner, P. Robriach. Gas burner, P. Robriach. Gas burner, P. Robriach. Gas burner, P. Robriach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Plerson. Gate lock, G. L. Burrows, Jr. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glove, D. L. Engel. Glove fastener, G. E. Adams Governor. feed regulator, K. Dougan. Grain drier, J. S. Metcaif. Grinder, sickle, B. C. Rockwell. Gun, air, J. C. Raymond. Hair pin, J. Berkey. Hame fastener, J. Pulley Hammock, T. Nesom. Harrow tooth, J. Beaty, Jr. Harvester, fodder, A. W. Addington. Hat finishing lathe, J. B. Howe. Hat rims, etc., rotary cutter for cutting or trim ming edges of, Giddings & Swain. Alay press, C. A. Anderson. Hay rack, D. King. Hay sling, H. L. Ferris. Heater, See Feed water heater. Furnace o heater. Tire heater. Water heater. Heating and ventilating, W. P. Powers. Heating and ventilating, W. P. Powers. Heating and ventilating, Toons or houses, device. for, J. Cinnamon.	588,558,658,658,658,658,658,658,658,658,
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Eishout. Gas burner, F. R. Fennessy. Gas burner, P. Rohrbach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Plerson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Glove, G. L. Eurows, Jr. Generator. G. E. Adams Governor. feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, sickle, B. C. Rockwell. Grun, air, J. C. Raymond. Hair pin, J. Berkey. Hame fastener, J. Pulley. Hammock, T. Neson. Harrow tooth, J. Beaty, Jr.	588,558,658,558,658,658,658,658,658,658,
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Elshout. Gas burner, P. Robrobach. Gas burner, P. Robrobach. Gas burner, P. Robrobach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Pierson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Gloss finishing machine, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Glove fastener, G. E. Adams. Governor. feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, sickle, B. C. Rockwell. Gun, air, J. C. Raymond. Hair pin, J. Berkey. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Hammock, T. Nesom. Harrow tooth, J. Beaty, Jr. Harvester, fodder, A. W. Addington. Hat finishing lathe, J. B. Howe. Hat rims, etc., rotary cutter for cutting or trim ming edges of, Giddings & Swain. Hay rack, D. King. Hay rack, Reeves & Morris. Hay and wentilating, W. P. Powers. Heating and ventilating rooms or houses, device for, J. Chnamon. Heating apparatus, steam or hot water, C. A. Sawin. Hook and eye, E. M. D. Landenberger. Hook and eye, E. M. D. Landenberger. Hook and eye, E. M. D. Landenberger.	588,558,558,558,558,658,558,658,558,658,558,658,558,5
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Elshout. Gas burner, P. Robrobach. Gas burner, P. Robrobach. Gas burner, P. Robrobach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Pierson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Gloss finishing machine, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Glove fastener, G. E. Adams. Governor. feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, sickle, B. C. Rockwell. Gun, air, J. C. Raymond. Hair pin, J. Berkey. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Hammock, T. Nesom. Harrow tooth, J. Beaty, Jr. Harvester, fodder, A. W. Addington. Hat finishing lathe, J. B. Howe. Hat rims, etc., rotary cutter for cutting or trim ming edges of, Giddings & Swain. Hay rack, D. King. Hay rack, Reeves & Morris. Hay and wentilating, W. P. Powers. Heating and ventilating rooms or houses, device for, J. Chnamon. Heating apparatus, steam or hot water, C. A. Sawin. Hook and eye, E. M. D. Landenberger. Hook and eye, E. M. D. Landenberger. Hook and eye, E. M. D. Landenberger.	588,558,558,558,558,658,558,658,558,658,558,658,558,5
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schaap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Elshout. Gas burner, P. Robrobach. Gas burner, P. Robrobach. Gas burner, P. Robrobach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Pierson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Gloss finishing machine, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Glove fastener, G. E. Adams. Governor. feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Grinder, sickle, B. C. Rockwell. Gun, air, J. C. Raymond. Hair pin, J. Berkey. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Hammock, T. Nesom. Harrow tooth, J. Beaty, Jr. Harvester, fodder, A. W. Addington. Hat finishing lathe, J. B. Howe. Hat rims, etc., rotary cutter for cutting or trim ming edges of, Giddings & Swain. Hay rack, D. King. Hay rack, Reeves & Morris. Hay and wentilating, W. P. Powers. Heating and ventilating rooms or houses, device for, J. Chnamon. Heating apparatus, steam or hot water, C. A. Sawin. Hook and eye, E. M. D. Landenberger. Hook and eye, E. M. D. Landenberger. Hook and eye, E. M. D. Landenberger.	588,558,558,558,558,658,558,658,558,658,558,658,558,5
Furniture, collapsible, W. H. Vaughan. Furnow opening or closing mechanism. C. E. Stewart. Game illustrating apparatus, base ball, A. K. Schap. Game indicator, E. Brooks, Jr. Gas, apparatus for generating and storing acety lene, O. T. de Sieghardt. Gas, apparatus for manufacturing, Bosselaar & Van den Elshout. Gas burner, P. Robrobach. Gas burner, P. Robrobach. Gas burner, P. Robrobach. Gas engine or motor, electrically controlled, G. L. Thomas. Gas, process of and apparatus for manufacturing H. M. Plerson. Gate lock, G. L. Burrows, Jr. Generator. See Steam generator. Glass finishing apparatus, S. G. Vogeley. Gloss finishing machine, S. G. Vogeley. Glove, D. L. Engel. Glove, D. L. Engel. Glove fastener, G. E. Adams. Governor. feed regulator, K. Dougan. Grain drier, J. S. Metcalf. Griuder, sickle, B. C. Rockwell. Gun, air, J. C. Raymond. Hair pin, J. Berkey. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Hame fastener, J. G. Miller. Hammock, T. Nesom. Harrow tooth, J. Beaty, Jr. Harvester, fodder, A. W. Addington. Hat finishing lathe, J. B. Howe. Hat rims, etc., rotary cutter for cutting or trim ming edges of, Giddings & Swain. Hay rack, D. King. Hay rack, D. King. Hay rack, Reeves & Morris. Hay rack, Reeves & Morris. Hay sling, H. L. Ferris. Heater, See Feed water heater. Furnace on heater. Tire heater. Water heater. Heating and ventilating, W. P. Powers. Heating and ventilating rooms or houses, devictor, J. Chnamon. Heating apparatus, steam or hot water, C. A. Sawin. Heaten, electric, C. S. Bradley. Hook and eye, E. M. D. Landenberger. Hook and eye, E. M. D. Lande	588,4 558,5 558,6

ß۱	Lamp bulbs, apparatus for detaching electric, O.	
8	Lamp burners, fixture for incandescent, J. W.	558,573
7	McKnight. Lamp, electric glow, E. A. Colby. Lamp, electric stand, R. Graves. Lamp, incandescent bydrocarbon, S. Marcus	558,911 558,634
8	Lamp, incandescent hydrocarbon, S. Marcus Leather cutting machine, E. Van Osta	558,589 558,864
9	Lamp, incandescent bydrocarbon, S. Marcus. Leather cuttling machine, E. Van Osta. Lifting jack, E. Covert. Limb, artificial, S. M. Kellum. Lock. See Bicycle lock. Gate lock. Lock, W. A. Johnston. Loom, needle, G. H. Cummings. Loom shuttle, J. Allen. Loungshuttle, J. Allen. Lounge, M. H. McCune. Lubricator, Grimes & Wakefield. Lubricator, J. M. Shartle.	558,581 558,816
	Lock. See Bicycle lock. Gate lock. Lock, W. A. Johnston.	558,649
3 3	Loom shuttle. J. Allen	558,721 558,753 558,570
8	Lounge, M. H. McCune	558,830 558,488
9	Lubricator, J. M. Shartle.  Mail pouch or bag, E. H. Middaugh.  Matte from slag, apparatus for separating, M.  W. Isles	558,528 558,826
2	Matte from slag, apparatus for separating, M. W. Isles	558,648 558,715
7	Meter indicating and registering apparatus, P.	000,110
Ď	Milking machine, A. Shiels	558 666
1 2	Mining and separating machine, ore. M. Covel Mixing machine, C. Greene	558,674 558,802
4	Mixing machine, C. Greene. Mixing machine, W. M. Jennings Motive power, device for regulating, B. A. Fiske Motor. See Car motor.	558,724
1	motors, automatic governing device for, merritt	558,507 558,731
8 8	& Joy	
2	Bond Music leaf turner, F. T. Joyce Musical instrument, R. W. Pain. Musical instrument bridge, G. R. Stebbins Musical instrument plectrum, Gery & Dolge Musical instrument tail piece, J. Murdock, Jr. Nut lock, D. Gibbons Nut lock, C. J. McCloskey Nut wrench, axle, J. Grannis.	558,478 558,496 558,562
8	Musical instrument bridge, G. R. Stebbins Musical instrument plectrum, Gery & Dolge	558,619 558,797
2	Musical instrument tail piece, J. Murdock, Jr Nut lock, D. Gibbons	558,699 558.799
5	Nut lock, C. J. McCloskey Nut wrench, axle, J. Grannis. Oil, refining, C. A. Smith Oil supply tank, F. R. Fennessy. Opera glass bolder. R. Wittmann. Ore concentrator, Wennen & Hart. Ore consentrator, Wennen & Hart. Oven, J. H. Mitchell Oyster dredger, N. Boudreaux. Padlock, C. T. Hunt Padlock, W. H. Taylor. Painting apparatus, R. Gunton, Jr. Paper drier, R. H. Aldrich Partition or wall, tile, G. S. Angus Patterns, apparatus for producing, F. Crakauer. Pencil, H. & H. Hunt, Jr. Piano legato attachment. R. C. Schirmer. Picture banging device, W. P. Cave Pin. See Hair pin.	558,658 558,874 558,747
1 3 2	Oil supply tank, F. R. Fennessy Opera glass bolder. R. Wittmann	558,643 558,889
5	Ore concentrator, Wennen & Hart Ore crusher, H. Gregory, Jr	558,915 558,803
4	Oyster dredger, N. Boudreaux	558,767 558 814
6	Padlock, W. H. Taylor. Paint agitator, T. Neal.	558,623 558,738
0	Painting apparatus, R. Gunton, Jr Paper drier, R. H. Aldrich	558,805 558,628
2	Partition or wall, tile, G. S. Angus	558,780 558,780
,2	Piano legato attachment. R. C. Schirmer Picture hanging device. W. P. Cave.	558,524 558,548
6	Pin. See Hair pin. Pin. J. A. Davidson. Pipes, instrument for removing obstructions	558,639
1	Pipes, instrument for removing obstructions from, W. C. Dillman	558,549
2	from, W. C. Dillman	558,549 558,768 558,849
9 4 1	LeavittPlow, garden, R. H. Hick	558,500 558,492
13		EED OOF
5 2 7	Pocket book, F. Hasselberger	558,641
14	Preserving fruits, vegetables, etc., C. F. Buckley Press. See Baling press. Die press. Embossing	558,835 558,629
1		
59	Pressure regulator, W. S. Johnson	558,490 558,593
97 31	Frinting device; daily, E. Harris.  Frinting machine inking apparatus, R. Miehle  Printing machine. rotary web, F. Meisel  Printing press gage pin, J. W. Eggleston  Printing press inking attachment, S. J. Hart  Printing press inking mechanism. R. Miehle  Pulp articles, apparatus for making, C. A. Dean et al.	558,551 558,551
(4 13	Printing press inking mechanism. R. Miehle Pulp articles, apparatus for making, C. A. Dean	558,594
18	et al	558,676 558,766
45 50	Ougdrievele H N Staats	558 856
5 17	Rack. See Hay rack. Rail bending machine, G. E. Smith	, 558,706
87	Rail joint, J. W. Johnson	558,495 558,527
92	Rail tongs, roller, R. L. Adams	. 558,752 . 558,858
04 09 39	Railway signal shiftingapparatus, F. M. Brincker- hoff.	. 558.770
60	Railway switch, J. Christiansen	558,600 558,603
99	Railway switch, E. B. Entwisle	. 558.791 . 558.807
23 84 62	Rack. See Hay rack. Rail hending machine, G. E. Smith	. 550,002
94 02		
98 14 04	regulator. Relay, F. E. Chapman Rheostat or heater, electric, H. W. Leonard Riveter, hydraulic, V. Schonbach Rock boring machine, R. Meyer. Rocker, Boenning & Gilson Rocking chair, S. E. Blake. Roller, See Spring roller.	. 558,672
68 34	Riveter, hydraulic, V. Schonbach Rock boring machine, R. Meyer.	. 558,850 . 558,652
87	Rocker, Boenning & Gilson	. 558,476 . 558,709
57 85 01	Roller. See Spring roller. Ruling machine, paper, L. S. Bigelow. Sash fastener, L. S. Bache. Saw, hack, G. T. Culver. Scale, self registering J. Campbell. Scissors or shears, G. P. J. chnson. Screw cutting machine, C. W. Bloemker. Seal, car, L. J. Genett. Seaming machine, sheet metal, J. P. Luckett. Seed cleaning machine, cotton, J. J. Faulkner. See d fell, H. Schimpff. Sew ing machine, Z. T. French. Sewing machine, P. H. Richards. Sewing machine, book, I. Nasch. Sewing machine, leedle, F. H. Richards. Shafting straightening and polishing machine, P. Medart.	. 558.764 558.757
01 29	Saw, back, G. T. Culver. Scale, self registering, J. Campbell.	. 558,781 . 558,630
53 13	Screw cutting machine, C. W. Bloemker	. 558,494 . 558,713
97 21 01	Seal, car, L. J. Genett.  Seaming machine, sheet metal, J. P. Luckett  Seed cleaning machine cotton, J. J. Faulkner	. 558,734 558,680
37	See d drill, H. Schimpff Sewing machine, Z. T. French	. 558,520
94	Sewing machine, F. H. Richards558.662 Sewing machine, book, I. Nasch	. 558,663 . 558,833
93  54  65	Sewing machine needle, F. H. Richards Shafting straightening and polishing machine, P	. 558,664
78	Medart	. 558,591 . 558,916 . 558,65
71	Medart. Sbarvening machine, H. K. Wheeler. Shaving knife, W. H. Mohr. Shet metal, machine for making curved moulding and embossing, C. J. Colling.	. 558.67
\$9 46	Shovel. See Steam shovel.	. 556,571
10	' signal.   Signaling system, W. F. Larkins	558.82
02 45	Sink trap, B. H. Sanders	. 558,569 . 558,830
49	Sheigh. W. L. Haag. Smoke consumer, W. C. Welsh.	. 558,88
40 47	Soldering iron, R. C. Becker	. 558,75 . 558,88
37 36	Spindle and bearing, M. Moriarty, Jr	. 558.82
36 04 80	Vivian Spooling machine bobbin bolder, S. N. Bourne	. 558,53 . 558,89
80 000 08	Spring roller, T. M. P. Chapman	. 558,48 . 558,56
$\frac{22}{41}$	Stable floor, C. D. Smith Steam boiler, O. Jones	. 558,57 . 558,91
71 95	Steam boller. J. A. Mumford Steam coupling, J. C. Mitchell	. 558,69 . 558,69
i20 334 169	Stam boiler, O. Jones. Steam boiler, O. Jones. Steam coupling, J. C. Mitchell. Steam generator, J. G. Cooper. Steam shovel, J. Campbell. Steam shovel, Campbell.	558,63 558,63
27 310	Steam shovel, D. H. Kelley Steering gear, controlling valve apparatus for	558,90
187	W. R. G. Hay Stereotype plate holder, adjustable, C. C. Keller.	. 558,80 . 558,58
54 198	Stone dressing tool, S. H. Pickering.	558,73 559,40
342 186	Stopper. See Bottle stopper. Stove, combined fuel and gas. W. D. Southard	. 558.61
<b>31</b> 0	Stove, cooking, F. Will. Stove lid lifters, etc., device for suspending, J. F	558.62
777	Store or renge C P Cregory	. 558.80
665 714		. 555,50
319 316	Strainer, nop. G. Schacke	558.57
560 847	Street sweeper, C. B. Brooks et al	. 558,71
751 377 765	Swaging round articles, machine for, W. H	. 558,78
723	Switch. See Contact switch, Railway switch.	. 558,78
7 <b>5</b> 8	Caringo E do Postron	
642 660	Tank. See Oil supply tank.  Teaseling machine, E. Gessner.  Telegraph key. W. E. Simons.  Teleuraph or similar wires, wire clamp for, G Middleton.  Tejegraph, printing, Merritt & Joy  Telephone, S. D. Field.	. 558,79 . 558.61
<b>19</b> 9	Telegraph or similar wires, wire clamp for, G	558,50
362 907	Telephone, S. D. Field	. 558,50 . 558,58

PRIESTMAN SAFETY OIL ENGINE

Phenomenally low in cost of operation."-Franklin Inst

Room 530, PHILADELPHIA BOURSE

DYNAMO and motor castings for amateurs. Send stamp for circular D. 4 light, 50 volt

Dynamo \$17.00 net. Motor Batteries. W. GRANT MOORE, La Fayette, Ind.

The Chicago Gas & Gasoline Engine

This beats Wind, Steam, or Horse Power, We offer the WEBSTER 2½ actual horse power GAS ENGINE

for \$150, less 10% discount for cash. Built on interchangeable plan. Built of best material. Made in lots of 100, therefore we can make the price. Boxed for shipment, weight 800 pounds. Made for Gas or Gasoline.

Write for Special Catalogue.

Write for Special Catalogue.

1074 West 15th Street, CHICAGO

The simplest gas and gasoline engine on the market. Has no equal for absolute, steady speed and durability. It is a dwarf in size and a Samson in strength. Catalogue senton application.

MANUFACTURED BY

Motors, Dynamos

WE MANUFACTURE ALL SIZES, FOR ALL PURPOSES, LOWEST PRICES.

Illustrated circulars and full information sent free by mail.

CARD ELECTRIC MOTOR AND DYNAMO CO., G67 Bourse Bidg., PHILA., PA.

MANUFACTURED BY J. J. NORMAN CO., 48 "A" South Clinton St., CHICAGO, ILL.

NEITHER STEAM Kerosene, NOT Gasoline NOR ENGINEER

Economical, Simple, Safe, Automatic. For Electric Lighting, Pumping, Milling, etc.

PRIESTMAN & COMPANY, Inc.

chine Shop Tools.

Hill, Clarke & Co.

16 S. Canal St., Chicago

160 Oliver St., Boston.

Telephone apparatus, Stromberg & Carlson. Telephone trunk circuit, W. H. Hennessey. Thrashing machine feeder, F. W. Robinson. Ticket stamping and supplying apparatus, coin controlled, C. Berzdorf, Time recorder, watchman's, G. B. Bobling. Tire beater, F. Ringstmeyer. Tire, peumatic, Rowe & Heys. Tire, rubber, F. W. Huestis. Tire, valve, bicycle, J. Hardman, Jr. Tire, wheel, A. Gerstner Tires, unfation tube for pneumatic, W. Ellis Toy cotton ball, E. S. Lathrop. Trap jack, F. Robinson.	559 950
Telephone trunk circuit. W. H. Hennessey	558,859 558,686 558,844
Thrashing machine feeder, F. W. Robinson	558,844
controlled C Rerzdorf	558 471
Time recorder, watchman's, G. B. Bohling	558,477
Tire beater, F. Ringstmeyer	558,743
Tire, pheumatic, Rowe & Heys	558,471 558,477 558,743 558,708 558,689
Tire, valve, bicycle, J. Hardman, Jr	558,606
Tire, wheel, A. Gerstner	558,644 558,552
Toy cotton ball, E. S. Lathrop	558,733
Toy cotton ball, E. S. Lathrop.  Trap jack, F. Robinson.  Trap. See Sink trap. Water trap.  Treadle, J. E. Bradley.  Trenches for pipes, conduits, etc., machine for making and refilling, E. P. C. Girouard.  Trolley, J. H. Rabbitt.  Trolley for electric railway cars, H. P. Wellman.  Trolley pole supports, means for reversing, H. P. Wellman.  Trough. See Feed trough.  Tube. See Double shell tube.  Tube cleaning device, Forslund & Rumely.  Tube plate hole cutter, T. W. Felton	558,881
Treadle, J. E. Bradley	558,716
Trenches for pipes, conduits, etc., machine for	558,683
Trollev. J. H. Rabbitt	558,741 558,869
Trolley for electric railway cars, H. P. Wellman.	<b>5</b> 58,869
Trolley pole supports, means for reversing, H. F. Wellman	558,868
Trough. See Feed trough.	•,
Tube. See Double shell tube.	558,553
Tube plate hole cutter, T. W. Felton	558,553 558,583
Typewriter holder, drop leaf, Elliott & Maw-	550 700
Typewriting machine, A. Davidson	558,484
Typewriting machine, A. B. Dick	558,790 558,484 558,582 558,795
Typewriting machine, J. H. Freeman, Jr	558,872
Typewriter noider, drop lear, Einott & Maw- hinney. machine, A. Davidson Typewriting machine, A. B. Dick. Typewriting machine, J. H. Freeman, Jr Typewriting machine cushion key, W. P. Devine Typewriting machines to dropping leaves of cabi- nets, etc., device for detachably securing, Elliott & Mawhinney.	
nets, etc., device for detachably securing,	558 789
Umbreila cane, R. Waples, Jr	558,789 558,867 558,914 558,530
Umbrella carrier, adjustable, V. A. Stumph	558,914
Umbrellas, etc., handle and stick for, E. Weidlich	558,884
Typewriting machines to dropping leaves of cabinets, etc., device for detachably securing, Elliott & Mawhinney. Umbrella cane, R. Waples, Jr Umbrella carrier, adjustable, V. A. Stumph Umbrella runner, J. Simmons Umbrellas, etc., handle and stick for, E. Weidlich Umbrellas or parasols, rib tip holder for, H. Scudder	
Valve. O. J. Baldwin	558,708
Valve, automatic pressure reducing, T. P. Ford	558,794
Valve, balanced slide, G. S. Vaughn	558 785
Valve gear, H. Wojan	558,544
Valve, reducing, C. H. Prusmann	558,839
Valve, triple, W. E. Prindle	558,838
Vapor bath, collapsible, G. M. Sternkopf	558,857
Vehicle wheel, B. S. Wood.	558,890
Vehicle wheel, road, P. Fyfe	558,796
Umbrellas or parasols, rib tip holder for, H. Scudder. Valve, O. J. Baldwin. Valve, O. J. Baldwin. Valve, balanced slide, G. S. Vaughn Valve balanced slide, G. S. Vaughn Valve for bottles, automatic, H. Dotzenroth, Jr. Valve gear, H. Wojan. Valve, reducing, C. H. Prusmann. Valve, steam cylinder, M. Berger. Valve, triple, W. E. Prindler Vapor bath, collapsible, G. M. Sternkopf. Venicle seats, B. J. McGrann. Velicle wheel, B. S. Wood. Vehicle wheel, R. S. Wood. Vehicle wheel, R. F. Hall. Velocipede pedal, R. F. Hall. Velocipedes, adjustable handle bar for, E. E. Hardy.	300,001
Hardy	558,489
	558,883
Vessel buffer, J. Ciocki	559 499
Vessel navigable L. O. Smith	558,671 558,575
Violin bow, W.J. Murdock	558,700
Wagon coal (2 B Mary	558,700 558,472 558,590 558,748
Wagon, dumping, J. A. B. Smith	558,748
Walton. Vessel buffer, J. Ciocki Vessel, marine, W. R. Bruner. Vessel, navigable, L. O. Smith Violin bow, W. J. Murdock Wagon bed scoop board, J. E. Bering. Wagon, coal, G. B. Marx Wagon, dumpins, J. A. B. Smith Washer, See Bottle washer. Washing machine, A. Mulder. Washing piece goods, apparatus for, Jackson &	558,697
Washing machine, A. Mulder	
Washtub cover, portable, R. F. Maiden	558,690
Watch balances, mechanism for truing, G. E.	558,824
Hunter	558,811
Hunter Watch cannon pinion, C. W. Hoen Water, etc., apparatus for raising, F. H. Merrill Water heater, G. H. Coit	558,558 558,880
Water heater, G. H. Coit	558,633
water trap and botter feed, combined return, w.	558,608
Norris	
thorn	558,685
treating fabrics for. H. L. Brevoort	558,717
Weather strip and door stop, A. M. Doyle	558,786
Wheel. See Vehicle wheel.	500,877
Wheel, H. E. Pridmore	558,519
Wind and water engine, combined, C. A. Rircher	558,475
Window, J. P. Higley	558,809
water tube boiler and tube lastening, J. Hay- thorn. Waterproofing or other purposes, electrically treating fabrics for, H. L. Brevoort. Weather strip and door stop, A. M. Doyle. Well drilling machine, R. H. Kersey. Wheel. See Vehicle wheel. Wheel, H. E. Pridmore. Wheel rim, wooden, J. Berkey. Wind and water engine, combined, C. A. Bircher Window, J. P. Higley. Wrench. See Nut wrench. Writing, aidto, G. Carlson.	558,632
	J

DESIGNS.

 Advertising card, F. B. Reynolds.
 25,399

 Badge, campaign, J. S. Blinn
 25,406

 Bedstead head or foot board, E. C. Baynes
 25,417

 Bicycle pedals, tread piece for, A. Sidwell
 25,424

 Bicycle saddle. H. & F. Mesinger
 25,423

 Book sheet, stock, C. Q. Holst
 25,401

 Bottle, E. H. Nelson
 25,402

 25,402
 25,403

TRADE MARKS. Beer and ale, Wm. J. Lemp Brewing Company... 28,177
Belts, pads, rings, bracelets, bandages and analogous devices, electric and magnetic, J. Spaldlogous devices, electric and magnetic, 5, 594.82
ling... 28,182
Bicycles, National Sewing Machine Company 28,185
Boots or shoes, William Dorsch & Sons Shoe
Manufacturing Company 28,153
Canned fruits and vegetables, Jersey Packing
Company 28,161 Company...
Canned goods, hermetically sealed, Twitchell-Champlin Company.
Canned tobster Muntwyler & Dubler...
Canned tomatoes and tomato extract, Joseph (Campbell Preserve Company.
Catamenial sacks, Oxford Manufacturing Company. 28,162 pany. 28,170
Catarrh cures, H. A. Kitchen. 28,170
Commutator bars, Forest City Electric Company. 28,183
Cosmetics, W. M. Carr. 28,167
Fisn, meats and lard, cured, Louch, Augustine & 28,159 Fish, meats and lard, cured, Louch, Augustine & Company 28,159
Glassware, cut or etched, Libbey Glass Company 28,180
Hominy or maize, prepared, Erie Preserving Company 28,158
Insecticides, Tube City Chemical Company 28,158
Knives, pocket and other, A. Bald win & Company 28,181
Medicinal barks, roots, and berbs and preparations
therefrom, U. S. Noyes. 28,175 Medicinal barks, roots, and berbs and preparations therefrom, O. S. Noyes. 22,175

Medicinal liquids or pellets for all forms of dyspepsia, J. J. Bissett. 22,174

Oats, rolled, American Cereal Company. 22,157

Ointments for bruises, sores, sprains, burns, skin diseases and the like, G. Kuchle. 22,169

Plows and cultivators, St. Joseph Manufacturing Company. 21,186

Remedies, certain named, J. H. Knoche. 28,171, 28,172

Remedies for mainutrition and all its symptoms, Moffit. West Drug Company. 28,176

Remedies for pulmonary blood, and other diseases, sunternal, A. F. Richardson 28,173

Remedy for bog cholera and similar diseases, 21,164

Rice, laminated or foliated, F. Dresser. 28,175

Soles, tap soles, and half soles, W. Kurzenknabe. 28,175

Tires, yielding or pneumatic, Boston Woven Hose and Rubber Company. 28,176

Tollet articles, including preparations for the teeth, hair, and skin, perfumery and toilet soaps, T. Churton. 28,168

A printed cony of the specification and drawing of

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of \$40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

#### Movertisements.

ORDINARY RATES.

Inside Page. each insertion - - 75 cents a line Back Page. each insertion - - - - \$1.00 a line TF For some classes of Advertisements, Special and Higher rates are required.

The above are cnarges per agate line—about eight words per line. This notice shows the width of the meand is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the rollowing week's issue.



# Foot and Hand Power Machinery

SEND FOR CATALOGUES— -Wood-working Machinery. -Lathes, etc.

SENECA FALLS MFG. COMPANY, 695 Water St., Seneca Falls, N. Y.

## POWER & FOOT | SHAPERS, PLANERS, DRILLS, LATHES, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNAT I. O.



#### THE CURTIS Steam & Grease SEPARATOR

IT WILL separate water from steam, and so deflect the water that it cannot pet back into the current.

IT WILL separate grease and sediment from exhaust steam. The grease may be drawn off at intervals, and the sediment removed.

EF Send for Circular S. E.

D'ESTE & SEELEY CO.

29-33 Haverhill Street, Boston.

. PHYSICAL AND SCHOOL APPARATUS . INDUCTION COILS for experiments in X rays and other electrical work. Catalogue Free.

E. S. RITCHIE & SONS, BROOKLINE, MASS.

**NEW PATTERN 12 INCH SWING** 



Stiff, Strong, and

F. E. REED COMPANY,

ONITOR VAPOR ENGINE AND POWER COMPANY, 8 ERIE STREET, GRAND RAPIDS, MICHIGAN.





### BELTING of Various Styles, ELEVATORS, CONVEYORS, COAL MINING and HANDLING MACHINERY.

The JEFFREY MANUFACTURING CO., COLUMBUS, O. Send for late Catalogue "C." Branches: CHICAGO—NEW YORK.



Little Giant Drilling Machine ARMSTRONG'S \* PIPE \* THREADING WITH STRAIGHT TABLE.

WITH STRAIGHT TABLE.
Furnished also with swinging table
Arranged for both Hand and Power.
Drills from ½ to 1½ inch hole.
Drills to center of 1½ inch circle.
Table is perfectly square with spindle and has adjustment of 16 inches.
Feed has a run of 4 inches.

Feed has a run of 4 inches.

Feed has a run of 4 inches.

WELLS BROS. & CO., Greenfield, Mass.



# The L. S. STARRETT CO. ATHOL, MASS., U. S. A. S

# A Book of Tools



The "Scientific American" says of the Book of Tools: "It is so excel-lently made up, and is full of such valuable information, that it fairly eclipses many works sold simply on **thei**r merits.'

"A Book of Tools" is our catalogue, 550 pages, over 2,000 illustrations of Machinery, Tools and Supplies of all kinds, and we will send a copy free post-paid to any address uponreceipt of 25 cents in stamps to cover cost of post-

age and advertising.

CHAS. A. STRELINGER & CO. Address Advertising Dept.,
Box 12% Detroit, Mich.

No Noise.

No LICENSE.

ABSOLUTELY SAFE

**BUILDERS OF THE** 

. . . AND . . .

**GASOLINE ENGINES** 

Marine Service.

#### RON WORKS COMPANY, ENNSYLVANIA



Launch with 9-I. H. P. "Globe" Engine, property of F. F. Milne, Island Heights, N. J.

Catalogues and Prices on application.

Address, 50th Street and Lancaster Avenue, PHILADELPHIA, U.S. A. Backus Water Motor Co., Newark, N.J., U.S.A.

## FOOT POWER LATHES



For Electrical and Experimental

Work Gunsmiths and Tool Makers General Machine Shop Work Bicycle Repair Work

High Grade Tools Elegant in Design Superior in Construction

THE BEST FOOT POWER LATHES MADE. CATALOGUE W. F. & JOHN BARNES CO.

1999 RUBY STREET, ROCKFORD, ILLS.

DO YOUR OWN
PRINTING
St. PRESS for cards, circulars, &c Press for printing a small paper, \$40.

Save money! Make money printing for others! "lype-setting easy. Printed rules. Write for catalogue, cards, etc., to factory. KELSEY & CO. Meriden, Conn.

Easily operated.

**IMPROVED** ADJUSTABLE

'S" WRENCH.

S" WRENCH.

Free and Accurate
Strong, Durable. For Circular, address
EMIS & CALL HARDWARE & TOOL CO.
CO. Box 1400. Springfield, Mass., U. S. A.

AMERICAN PATENTS. — AN INTEResting and valuable table showing the number of patents granted for the various subjects upon which petitions have been filed from the beginning down to December 31, 1894. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NO. 1002. Price 10 cents. To be had at this office and from all newsdealers.



Marine Vapor Engine Co., Jersey City, N. J

SMALL GASOLINE LAUNCHES 



# Worcester Polytechnic Institute Worcester, Mass, in Mechanical, Civil and Electrical Engineering and Chemistry. 18s-page Catalogue, showing appointments secured by graduates, mailed free. Expenses low. 20th year. T. C. MENDENHALL, President. THE COBURN PATENT TROLLEY TRACK

**CUTTING-OFF MACHINES** 

Both Hand and Power.
Sizes 1 to 6 inches.
Water, Gas, and Steam Fitters' Tools, Hinged Pipe Vises,
Pipe Cutters. Stocks and Dress universally acknowledged to be THE BEST. To Send for catalog.

THE ARMSTRONG MFG. CO. Bridgeport, Conn.

Mounted Lightning Screw Plate

Send for Catalogue.

Wiley & Russell Mfg. Co., Greenfield, Mass., U.S.A

ACETYLENE APPARATUS.—ACETY-lene number of the Scientific American Supplement, describing, with full illustrations, the most for generating acetylene on the large and small scale. The gas as made for and used by the microscopist and student; its use in the magic lantern. The new French table lamp making its own acetylene. Contained in Scientific American Supplement, No. 1057. Price 10 cents. To be had at office.

PERFORATED

OF EVERY

OF EVERY

OF ENERGY OF AND FOR ALL USES

FERFORATING CO.

PERFORATING CO.

CHICAGO. ILLUSA ! Miles PEARLS: NEW YORK

STORY OF THE PERFORMANCE OF TH

Barn Door Hangers

Impossible for door to jump the track.

Very simple and cheap to apply.

EST Send for Book. Send for Book.

THE COBURN TROLLEY TRACK MFG. CO., HOLYOKE, MASS.



This SCREW CUTTING LATHE (cuts Right and Left threads) 6 inch 4-jaw Chuck-jaws reversible, 6 Lathe Tools, Set Twist Drills, \$69.85.

FRED FRASSE CO. 21 Warren Street, New York



EDGE TOOLS are often nearly ruined by using a grind-stone not adapted to the work. Our stone not adapted to the work. Our quarries produce a large variety of grits suitable for grinding any tool.

15 May we send you our Catalogue, which will give you some information?

GRAFTON STONE COMPANY,

No. 80 River Street,

GRAFTON, OHIO.







e anufacture MINING MACHINERY of every description Gates Iron Works, Dept. C, 650 Elston Av. Chicago,!!!

best Motor in the world for driving all kinds of t machinery, noiseless, neat, compact; invaluable blowing church organs, running printing presses, se mills, ventilating fans, ice cream freezers, meat pers, etc. In use the world over, and recommended tater companies everywhere. Address for circular,

The only saddle that is built on anatomical principles. Used, recommended and endorsed by physicians. Has thick cushion pads where pads are needed. If it is fixed to your bicycle, there will be no chafing stiffness or soreness, and riding will be made a pleasure. Especially adapted for women cyclists.

PRICE \$5.00.

CHRISTY...

Anatomical • Saddle

Meets Every Requirement of the Modern Cyclist.

A. G. SPALDING & BROS. 128 Nassau St., NEW YORK.

Latest models, fully guaranteed; pneumatic tires; weight 17½ to 30 lbs.; all styles and prices. Large illustrated catalogue free. Cash Buyers' Union, 162 W. Van Buren St. B-131 Chicago

THE Duquid

FREE!

A bandsome
fillustratde deatalogue
son receipt
of address

High Grade Bicycles

Shipped anywhere C. O. D., at lowest wholesale prices. \$100 '0akwood' for\$57.50 \$85 'Arlington' "\$45.00 \$86 "\$37.50 \$20 Bleyele "\$10.75 sumatic tires; weight 17% to

CYCLE SADDLE



VENTILATING
Fans are invaluable for Restaurants, Hotels, Meat Markets, Saloons, Lunch Counters, Groceries, Bakeries, Confectioneries, and in fact all places troubled with heat on flies. The only perfect Fan made that can be driven at any speed without disturbing the belt.

Prices, from \$6 to \$35. Send for circular, to BACKUS WATER MOTOR Co., NEWARK, N. J



\$1 currency or stamps will bring you a sample 1½ oz. capacity. Money re-CRANK PIN OILER funded if not satisfactory. Penberthy Injector Co., 116 Seventh St., Detroit, Mich.



### **Automatic Circular Rib** Knitting Machinery

for all kinds of Ribbed Goods, Vests, Pants. Sleeves, Sweaters, Tights, Skirts, and every thing known to the trade as ribbed goods

SNYDER & FISHER, LITTLE FALLS, N. Y

ACETYLENE GAS AND CARBIDE OF ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Apparatus for making the gas. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035 and 1038, The most recent apparatus of simple and more elaborate type described and illustrated in special acetylene Supplement No. 1057. Price 10 cents each. To be had at this office and from all newsdealers.



Durable-Easily Applied. This roofing is manufactured from natural Trinidad asphalt materials, and will not dry up and become brittle under exposure to the weather as coalar roofings do. F. Send for free sample of roof 12 years old, with circular and price list to W MARKEN CHEMICAL & MFG. CO... A DURABLE ROOFING, S5 Fulton Street, New York, U. S. A.

Reagan Feed Water Heating, Water Circulating and Shaking Grates



for Stationary, Marine, and Locomotive Boilers. AGENTS WANTED in all parts of the United States to manufacture our grates on royalty.

Send for Catalogue.

Water Circulating Grate Co, Manuf's and Sole Proprietors GENERAL OFFICE & WORKS, 1026-1028 Filbert St., PHILA., PA

CLARK'S PATENTED-

Rotary Upholstery Brush.



NICKEL

**ELECTRO-PLATING** Apparatus and Material.

Hanson & Van Winkie Co. Newark, N. J. 81 LIBERTY ST., N. Y. 35 & 37 S. CANAL ST., CHICAGO.

CROOKES TUBES AND ROENTGEN'S CROOKES TUBES AND ROENTGEN'S Photography.—The new photography as performed by the use of Crookes tubes as a source of excitation. All about Crookes tubes. Scientific American Supplement, Nos. 181, 189, 238, 243, 244, 792, 795, 905, 980, 1050, 1054, 1055, 1056, 1057, also Scientific American, Nos. 7, 8, 10 and 14, vol. 74. These profusely illustrated Supplements contain a most exhaustive series of articles on Crookes tubes and the experiments performed with them. Among them will be found Prof. Crookes' early lectures, detailing very fully the experiments which so excited the world, and which are now again exciting attention in connection with Roentgen's photography. Price 10 cents each. To be had at this office and from all newsdealers.



DYNAMOS & ELECTRIC MOTORS Our 10 to 75 light Dynamos are pronounced a success by all who have them in use. High grade, compound wound, self-coiling, self-aligning bearings, high efficiency and great durability guaranteed. Lowest prices. Do your own lighting, no experience required send for catalogue and apriess. Complete plants furnished.

100 TH BR OS. & CO., Mfrs.. 30-34 Market Street, Chicago, Ili., U.S. A.

BRICK FOR ALL PURPOSES.

BROOKLYN FIRE BRICK WORKS. 88 Van Dyke Street, BROOKLYN, N. Y.



# Eclipse.

Cream Separators

are Closest Skimmers, Most Durable,
Easiest Running, and far the Simplest
Hand or Power Separator on the
market.

E. Agents Wanted.

C. L. CHAPMAN SEPARATOR WORKS, LITTLE FALLS, N. Y.

## A Cleaner That Cleans—



### The Great "BALL NOZZLE **BOILER FLUE CLEANER.**

It is so simple, yet effective. It throws an oval spray at great force along the sides of the tube, rapidly removing all incrustations of dirt, soot, etc. Manufactured only by the

AMERICAN BALL NOZZLE COMPANY, 831 Broadway, New York City



49 Dey St., New York City.

DIXON'S 691

GYCLE CHAIN

GRAPHITE

saves wear of chain, prevents rust and increases ease, speed and comfort.

It will pay you to send 10 cents for sample. JOS. DIXON CRUCIBLE CO., JERSEY CITY, N. J.

POOLE & SON ENGINEERS. FOUNDERS MACHINISTS OF MACHINISTS OF MACHINISTS OF ALL KINDS OF HEAVY MACHINERY. REQUIRING FIRST CLASS WORKMANSHIP AND MATERIALS

EMPORITE WHEELS TO NOT CHES LEYS THE PROPERTY OF THE MOLDED SHAFTING PROPERTY OF THE MOLDED SHAFTING MACHINE MOLDED GEARING. POOLE-LEFFEL TURBINE

CACHARS ON APPLICATION

F. C. AUSTIN MFG. CO., CHICAGO ILL.

The Number SIX New Model

Remington

Standard Typewriter

is not built that way. Its improvements are Real-real to the experienced operator, as

well as attractive to the novice.

A development—not an experiment.

FACTS PROVE IT

SEND FOR A BOOKLET

Wyckoff, Seamans & Benedict 327 Broadway, New York

interest the novice but excite the scorn

Many Typewriter Improvements=

HARVEY HUBBELL Machinery and Tool Mfr. Improved Tapping Machines Machine Screws for electrical purpose Sample box free. BRIDGEPORT, CONN.

Watchman's Improved Time Detector with 12 or 24 Keys, with Safety Lock attachment.

Bafety Lock attachment. all concerns selling crusing the Safety Lock attachment, cording to Decision of Circuit Court of U. S. for S. D. of N. Y. Send for circulars to E. IMHAUSER. 206 Broadway, New York, P. O. Box 2875,

BOSTON ELECTRIC RAILWAY SUB way.—Description of a new subway system under certain streets of Boston, by means of which the electric cars will be diverted from the surface of the streets on some of the heaviest lines of travel. With 8 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1017. Price 10 cents. To be had at this office and from all newsdealers.



WHICH ARE THE MOST WONDERFUL THINGS ABOUT

MARKS' PATENT ARTIFICIAL LIMBS,

KLINE'S PATENT IMPROVED Boss Jar Holder and Top Wrench Entirely new-Fits any jar.

No more burned hands in canning fruit—No more broken jars while filling—No trouble to carry hot jars—No more bad temper trying to open jars—No more trouble to close them—Made of best steel wire and rubber—Will last a lifetime, Price 50c.per set KILINE & CO. MITS.,
4 River Street, Florin, Pa.



enable men, women, and children to pursue their daily duties without inconvenience. Durable, comfortable, natural in appearance and motions. Over 17,000 in use throughout the world. Supplied to the U.S. and other governments. Large illus, book and formula for self measurement, free.

A. A. MARKS, 701 Broadway, NEW YORK CITY.

for Ladies' use. Broad and comfortable, and guaranteed to hold its shape. Most sensible and serviceable Saddle in the market. Twenty years' experience in working leather enables us to make good this claim.

ALL STYLES GENTILEMEN'S SADDLES also. Ask for the formula if your dealer will not supply you, we will send, prepaid, on receipt of price: Ladies', \$4.00; Gentlemen's, \$3.50. Furnished with clip for T or L seat post. THE DUGUID SADDLERY CO., Syracuse, N. Y.

> Howard Chainless Bicycle. The first man in any town who buys one will be allowed an agent's discount and offered an agenty of the work of the buy for the whole, or allowed the cost. Address HOWARD, 711 Summer Av., Newark, N.A.

ONLY PRACTICAL MAGAZINE CAMERA.



**SUNART'S** "VENI, VIDI, VICI," SUNART MAGAZINE,

SUNART FOLDINGS. Send for Illustrated Catalogue-2 cent stamp.

SUNART PHOTO CO., ROCHESTER, N. Y.

The . . .

## Premo Camera



\* Styles for 1896 now ready

ROCHESTER OPTICAL CO., Rochester, N. Y.





DEAFNESS and HEAD NOISES relieved by using

Wilson's Common Sense Ear Drums New scientific invention, entirely different in construction from all other devices. Assist the deaf when all other devices fail, and where medical skill has given no relief. Safe, comfortable, and invisible; no wire or string attachment Write for pamphlet. WILSON EAR DRUM MANUFG. CO. Louisville Trust Co. Building, Louisville, Ky. Mention this paper. and 1122 Broadway, New York

## SMALL MOTORS for All Purposes

The best manufactured. Specially adapted fo all kinds of light work, sewing machine outfits toys, dental drills, jewelers' lathes, models, etc. Send for Catalogue. The I.E.A.VITT MOTOR CO.. Manufacturers of Electric Motors and Electrical Specialites, 122 Mitchell St., PROVIDENCE, R. I.

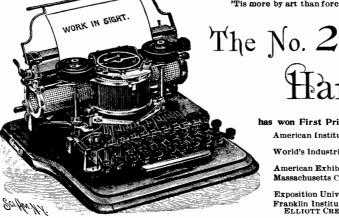


IT is the only perfect one.
IT will not blow or jar out.
IT gives a clear, white light.
IT is like an engine headlight.
IT throws the light straight
ahead from 200 to 300 ft.
IT burns kerosene,
Send for book (free).

R. E. DIETZ CO., 60 Laight Street, New York. Mention this paper and get special discount.



"It is not strength, but art, obtains the prize, And to be swift is less than to be wise. 'Tis more by art than force of numerous strokes."



Hammond has won First Prize in every competition. American Institute, New York, 1884, 1885, 1886, 1887, 1888.

World's Industrial Exposition. New Orleans, 1884, 1885. American Exhibition, London. 1887. Massachusetts Charitable Mechanics' Association, Boston, 1887. Exposition Universelle. Paris, 1889.

Franklin Institute, Philadelphia, ELLIOTT CRESSON GOLD MEDAL, 1891. The Hammond Typewriter Co.\_

401 East 62d Street, New York, Seetablished 1840.

Founded by Mathew Carey, 1785.

#### HENRY CAREY BAIRD & CO.

INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS S10 Walnut St., Philadelphia, Pa., U.S.A. Our New and Revised Catalogue of Practical and Scientific Books, 9 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.



The man who sets type needs connected in any way with typography or the allied arts. Printed and illustrated in the best style. New cover design each month. \$2.00 per year: \$1.00 for six months. The Inland Printer Company, 212-214 Monroe Street, Chicago; 197 Potter Building, 38 Park Row, New York.



On the Crest of the Alleghanies.

To those contemplating a trip to the mountains in search of health or pleasure, Deer Park, on the crest of the Allegheny Mountains, 3,000 feet above the sea level, offers such varied attractions as a delightful atmosphere during both day and night, pure water, smooth, winding roads through the mountains and valleys, and the most picturesque scenery in the Allegheny range. The hotel is equipped with all adjuncts conductive to the entertainment, pleasure and comfort of its guests. There are also a number of furnished cottages with facilities for housekeeping.

The houses and grounds are supplied with absolutely pure water, piped from the celebrated "Boiling Spring," and are lighted with electricity. Deer Park is on the main line of the Baltimore and Ohio Railroad, and has the advantages of its splendid Vestibuled Limited

Express trains between the East and West. Season excursion tickets, good for return passage until Octobe 31st, will be placed on sale at greatly reduced rates at all principal ticket offices throughout the country.

The season at Deer Park commences June 22d, 1896.

For full information as to rates, rooms, etc., address GEORGE D. DESHIELDS, Manager, Park, Garrett County, Mar Deer Park,

### BUY **ELEPHONES**

That are good—not "cheap things." The difference in cost is little. We guarantee our apparatus and guarantee our customers against loss by patent suits Our guarantee and instruments are BOTH (1001). WESTERN TELEPHONE CONSTRUCTION CO.,

250 So. Clinton Street, CHICAGO Largest Manufacturers of Telephones in the United States



### HELLO, CENTRAL!

The "best" is the cheapest in the long run, and ours are the best. A trial will convine you. Money back if it don't. Exchanges invited to take a pair on trial. Ten styles to choose from. Drop a postal in the slot and get illustrated catalog and particulars by return mail. PHCENIX INTERIOR TELEPHONE CO., 131 Liberty St., New York.

## A RARE OPPORTUNITY. TRUSTEE'S SALE.

By order of the Court, the plants and effects of the Buss Machine Works, located in this city and at Benton Harbor, Mich., will be sold to the highest bidder at the north door of the Kent County Court House in the City of Grand Rapids, Mich., at 10 o'clock a. m., on Thursday, May 14th, 1886. The main works are at Benton Harbor, which has water and rail transportation. The plant is most complete, specially constructed roomy buildings, machinery and tools in good order. The stock of made up and partially made up wood working machines, together with merchandise on hand, is such that the business can be started up at orce. The product of the Buss Machine Works is well and favorably known, and the good will of the company valuable. The works are open for inspection and a complete catalogue of the property to be sold and its order of sale, will be furnished on application, by undersigned or by the First National Bank of Benton Harbor, Mich.

F, LETELLIER, Trustee.



Positively Limited to June 1st.

Hundreds of Electricians, Inventors, Amateur Mechanics, Experimenters, College Students, Business and Professional Men, as well as many other readers of the SCIENTIFIC AMERICAN, have taken advantage of our phenonenal and surely liberal offers during 1895. Hundreds of letters are on file commending in the highest terms the superior merits of our Great Standard Dictionary and Encyclopedia of the world's knowledge. More than One Hundred Thousand Dollars have been expended in advertising this truly marvellous work during the past twelve months. On June 1st, our fiscal year will end. Until then, any reader of this paper can take advantage of our special offer and come into possession of the grandest reference library in existence, the

Each volun
3 inches 1

i volume 9 inches thick.

inches wide. Weight

of e

inches bout 40

long,

set 1111/2

# ENCYCLOPÆDIC DICTIONARY

## FOR \$1.00 CASH AND \$1.40 A MONTH FOR A YEAR.

olumes, substantially the state of columns of columns of columns of columns of columns. massive volun 5,357 pages, 1 ype matter, 3, 5,3 pe

CYCLOPÆDIC THE ENCYCLOPEDIO DICTIONARY TIONARY OLUME I. VOLUME II. ATORE. VOLUME III. CRE-INF VOLUME IV. RHE-Z. The four contain JUST AS THEY LOOK.

If you do not already own this great work, LOSE NO TIME in investigating our proposition. Do not overlook the fact that the work embodies all the features of a complete dictionary as well as an entirely up-to-date encyclopædia. It is to-day regarded throughout the entire English speaking world as the one great standard authority. It is the "court of last resort" on all questions in dispute. Schools, colleges, and public institutions by the score, SWEAR BY IT.

More than \$750,000, and the services of over 100 learned editors and specialists, employed to produce this magnificent self-educator.

It is a Complete Dictionary of the English language. Every word is exhaustively treated as to its origin, history, development, etymology, pronunciation and various meanings.

It is a Comprehensive Encyclopædia of anatomy, botany, chemistry, zoölogy, geology, art, music, agriculture, physics, philosophy, mechanics, history, mythology, biblical knowledge, etc. It is a Superb Library Book, substantially bound, printed from new plates, in large, clear type, on heavy white paper, and illustrated with thousands of new pictures made especially for this work.

It defines 250,000 words, and treats 50,000 subjects encyclopædically—nearly twice as many separate topics as are covered by the largest of other encyclopædias.

Adopted by the PHILADELPHIA BOARD OF PUBLIC EDUCATION

on February 1, 1896, in preference to all other Dictionaries and Encyclopædias; previously adopted by St. Louis, Toledo, Jersey City, etc., and now recognized as THE STANDARD IN PUBLIC SCHOOLS from Maine to California.

#### TWO EXPERT OPINIONS—THOUSANDS SIMILAR.

Rev. Charles H. Parkhurst, D.D.

Ex-Postmaster General Bissell.

New York, March 9, 1896.

Gentlemen:
The Encyclopædic Dictionary is a library condensed into four volumes; a ton of diffusiveness reduced to forty pounds of quintessence, and, withal, as delicate in detail as it is comprehensive in contents,
Yours very sincerely,
C. H. PARKHURST.

Service examined your Encyclopædic Dictionary, is a fund of encyclopedic in detail as it is comprehensive in contents,
Yours very sincerely,
Yours very truly,
W. S. BISSELL.

#### REMEMBER, UNTIL JUNE FIRST ONLY

readers of the SCIENTIFIC AMERICAN can obtain this unrivaled treasure-bouse of practical knowledge at a price but little above cost of paper, printing and binding, and on terms easy almost beyond belief.

HOW TO CET THIS CREAT WORK.—Send \$1.00 by post-office order, express order, or check, and the entire four handsome volumes will be forwarded. Every month thereafter send \$1.40 in the same manner, for twelve months, making the total payment \$1.7.80. Understand, the whole set of four volumes is sentafter the first payment of \$1.00, which gives you the use of them while paying the balance, at the rate of about 5 cents per day. All freight or express charges must be paid by the purchaser. Any one wishing to pay cash for the complete set may deduct 10 per cent. and send \$16.07. This allowance is practically the cost of keeping the account if purchased on easy terms. We refer to any commercial agency or any bank or newspaper in Philadelphia. N. B.—If the Half Russia style (regular price, \$52.00). Its elieves the payments will be \$1.75 a month; and the Full Sheep edition (regular price, \$50.00) will be furnished on monthly payments of \$2.00. The first nayment is only \$1.00 in any case, and the eash discountis allowed on all styles. When ordering, please state which style you select. We recommend the Inif Russia Bluding as more serviceable. Pamphiet of 80 specimen pages free on receipt of 6 cents to pay postage. Mention this paper.

Books guaranteed as represented, or money refunded if returned within ten days.

**AGENTS WANTED** 

SYNDICATE PUBLISHING COMPANY, 236 So. Eighth St., Philadelphia, Pa.

Engineers and Firemen Send 2c. stamp for 24 page pamphlet containing a list of questions asked by a board of examining engineers. Stromberg Pub. Co. St. Louis, Mo.



The Light Running

DENSMORE The World's Greatest Typewriter

SUPERIORITIES ESTABLISHED: Lightest key-touch, greatest speed, most convenient paper feed, best for both correspondence and manifolding, best system of scales.

FROM THE U. S. GOVERNMENT—DEPARTMENT OF THE INTERIOR, Washington, November 23, 1895.

Densmore Typewriter Company.
Gentlemen: We have now in use in the Bureaus of this Department nearly eight y Densmore machines. We have no complaint from the users of them, hence we conclude they are giving entire satisfaction.

Respectfully. (Signea) HIRAM BUCKINGHAM, Custodian. Free: Illustrated pamphet containing testimonials from leading concerns.

DENSMORE TYPEWRITER CO., 316 Broadway, New York

Invest Money, Energy, and Brains Profitably?

## The Opportunity for Live Men with or without Technical Knowledge Building Material.

Concrete and Twisted Iron construction ahead of all other systems in effectiveness, universality, and simplicity.

Concrete Surfaces (pitched, nigged, or tooled). The resemblance between these and unsightful Cracks prevented by shrinkage joints, invisible, unobjectionable.

CONCRETE WALLS built plumb by easily handled and economical molding apparatus.

SIDEWALK LIGHTS—Ransome's Monolithic—latest, cheapest, and best.

RANSOME'S PATENT RIGHTS—sold for States, counties, cities, or buildings.

DRAWINGS, CIRCULARS, and complete information upon application.

RANSOME & SMITH CO.,

622 Boyleston Building,

CHICAGO.

### FREE SAMPLE COPY

A New Elementary Technical Journal

Of 24 Pages, With a New Plan of Instruction in

MECHANICAL AND DRAWING For Machinists, Draughtsmen, Carpenters, Steam Engineers, Electrical Workers, Plumbers, Steam Fitters, Surveyors, Miners, High School Students. Address, HOME STUDY, B 942, SCRANTON, PA.

SCROLL SAWS Foot Power Machinery, Tools, Forges, Drills, etc. Send 40 for catalogue. Wilkinson Co., 88 Randolph St., Chicago

Shorthand by Mail Thoroughly taught by re-porters. Catalogue and first lesson Free. Potts Shorthand College, Williamsport, Pa.

MACHINES: Corliss Engines. Brewers' and Buttlers' Machinery. THE VILTER MFG. Co., 899 Clinton Street, Milwaukee, Wis.

DIES Models, Tools, Special and General Machinery made to order. Prices moderate. A. GUENARD 32 to 33 South 6th Street, BROOKLYN, N. Y.

507 MECHANICAL MOVEMENTS by Henry T. Brown. The Copyright of this work has been renewed for 14 years from March 28, 18%.

## MAGICLANTERNS WANTED OR EXCHANGE:

DRAUGHTING or SURVEYING taught by mail. Earn \$50 to \$100 a month. Positions secured. 2c. stamp for catalogue. Black Cor. School, Paterson, N. J.

IDEAS DEVELOPED. Absolute secrecy. Send for particulars. Advice and suggestions free. Correspondence and sample orders solicited. 25 years in business. Gardam & Son, & John St., New York.

DEAF NESS & HEAD ROISES CURED by my Invisible Tubular Ear Cushions. Whispers heard. Warranted to help more cases than all similar devices combined. Help earn as glasses do eyes. Sold by FREE F. Hiscox only, 858 Br/4way, N. Y. Send for book of proofs FREE

VOLNEY W. MASON & CO.

FRICTION PULLEYS, CLUTCHES, and ELEVATORS PROVIDENCE, Ř. I.











W. E. CALDWELL CO.. 217 E. Main Street, Louisville, Ky. WALKING MADE EASY by using Barnes' Self-Fastening Rubber Heels. No wearing down on side. The rubber can be turned. Noiseless. No fatigue. Price 50c., postage paid. Two sizes – men's and

women's.
REQUA MFG. CO., S8 Fulton St., New York

STEREOPTICONS.
MAGIC LANTERNS AND
ACCESSORIES, SEND FOR CATALOGUE
TO CHAS BESELERMAKER 218 CENTRE ST.
NEW YORK.

## cientific Book Catalogue

RECENTLY PUBLISHED.

Our New Catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application. MUNN & CO., Publishers Scientific American,

361 Broadway, New York



They have a tone that's all their own.... THE NEW are the stand-DEPARTURE lence the BELLS over. Made in 16 and prices. Send postal for booklet to THE NEW DE-PARTURE BELL CO., 210 North Main Street, Bristol, Conn., U. S. A.

"Smooth as if Ironed." "Smooth as if Ironed."
Trousers are kept so by using the Practical Trousers Hanger and Press. Money refunded if not satisfactory. For \$5.00, we send express paid, as est of 6 hangers and 3 rods, which, used in conjunction, enables the convenient close tarangement shown in cut. We sell hundreds of such sets. Illustrated booklet, with testimonials and fac-simile letters of duplicate orders, mailed free on resuest. Sample Hanger, 75c., prepaid, Sample Rod. 25c. Agents wanted. PRACTICAL NOVELTY OO, 425 Walnut St. Phila. Pa.



ହଥ⊍ USE GRINDSTONES?

if so, we can supply you. All sizes mounted and uninounted. always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. The CLEVELAND STONE CO. 2d Floor. Wilshire, Cleveland. O.



HYPNO'I'SM Sixty methods, \$5; my process \$2. 100 page book, 10c. Key to Power, 3. A. 5, Masonic Temple, Chicago.

## Waltham Watches

Made by the American Waltham Watch Co. are the best and most reliable timekeepers made in this or any other country.

> Ask to see the name "Riverside" or "Royal" engraved on the plates, and always the word "Waltham." For sale by all retail jewelers.



# **400,000** Pounds of Nickel Steel

drawn into tubing in our own mills, that has gone into Columbia Bicycles in the past year and a half. Its use is what makes Columbias so strong and light. No such material in other machines. Reserved exclusively for





Columbias in construction and quality are in a class by themselves.

Pope Manufacturing Co. HARTFORD, CONN.

The Name "HUNTER".

never was put on anything that wasn't first-class.

That name has stood for simple, plain, unvarnished integrity, and hence it is put on the . . .

# .. HUNTER CYCLES 13 Send for Catalogue. HUNTER ARMS CO., FULTON, N. Y.



## The American Bell Telephone Company,

125 Milk Street, Boston, Mass.

This Company owns Letters-Patent No 463,569, granted to Emile Berliner November 17, 1891, for a combined Telegraph and Telephone, covering all forms of Microphone Transmitters or contact Telephones.

There's no doubt about the advisability of riding a wheel-the only ques-

tion now is what wheel to ride.

King of Bicycles

represents cycle manufacture in its highest development. A wheel with which no fault can be found. 4 models. \$80 and \$100, fully guaranteed. For children and adults who want a lower price wheel the **Defiance** 

made in 8 models, 0 to \$75. Send for onarch book. MONARCH CYCLE MFG. Co. Lake, Halsted and Fulton Sts., CHICAGO.

88 Reade St., NEW YORK.

To Architects and House Owners

The use of Wheeler Patent Wood Filler on all natural interior woodwork insures a permanent fine finish, and leaves the wood pores perfectly transparent so that the full life of the wood is developed. No other wood filler is so good as the Wheeler, or is made of the same material.

The resinting the exterior or interior of a house Breiniers Lithogen Silicate.

In painting the exterior or interior of a house, Breinig's Lithogen Silicate Paint should be used. It stands where lead and oil fail, and outwears any other paint. Architects and owners in their own interests, should see their specifications carried out in full, and examine bills for the articles specified before accepting work as satisfactory.

References—Most of the leading architects throughout the U.S. Sole manufacturers of the above articles.

THE BRIDGEPORT WOOD FINISHING CO., New Milford, Conn. New York, 240 Pearl Street. Chicago, 215 E. Lake Street. Boston, 85 Oliver Street.



### If Inventors and Manufacturers

Having new articles of merit to place on the market will forward samples or description of their goods, they will receive careful attention and considerationby The Elastic Tip Co., 46 Market St., San Francisco, Cal.

# JESSOP'S STEELTHEVERY FOR TOOLS, SAWS ETC. WM JESSOP & SONS LP 91 JOHN ST. NEW YORK

BALL BEARING AXLES AND RUBber Tires.—A paper read before the Carriage Builders' National Convention, Philadelphia, October, 1894, showing the advantage to be derived from the use of ball bearings and pneumatic tires in road vehicles. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 992. Price 10 cents. To be had at this office and from all newsdealers.

ENGINES, Boilers and Machine Tools. New Machinery & Supplies." W. P. Davis, Rochester, N. Y.

### \$5.00 The POCKET KODAK

EASTMAN KODAK CO., ROCHESTER, N. Y.

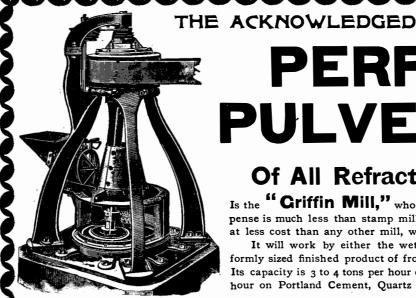
If you own a good HORSE

AND CARRIAGE you will be

interested in our



It will tell you honestly how many miles you drive, and announce each mile by stroke of a bell. Keeps a record for 1800 miles and then repeats. Spreed horses may be timed very accurately. Fully warranted. Price, by mail, \$5.00. In ordering send height of rear wheel. Write for Descriptive Circular



PERFECT **PULVERIZER** 

## Of All Refractory Substances

Is the "Griffin Mill," whose first cost, wear, and operating expense is much less than stamp mills, and which yields a larger product at less cost than any other mill, with perfect success in every instance.

It will work by either the wet or dry process, and deliver a uniformly sized finished product of from 30 to 350 Mesh, with equal facility. Its capacity is 3 to 4 tons per hour on Phosphate Rock, 1 ½ to 2 tons per hour on Portland Cement, Quartz Ores, etc.

Correspondence solicited, and illustrated descriptive catalogue sent free by mail on application to

Bradley Pulverizer Co., No. 92 State Street, Boston.

Gas and Gasoline Stationary Engines
CASOLINE TRACTION ENGINES
COMBINED ENGINES AND PUMPS CASOLINE PORTABLE ENGINES USED BY ANY ONE.
FOR ANY PURPOSE

CHARTER CAS ENGINE CO., P. 0. Box 148, STERLING, ILL.

AGENTS WANTED FOR FINE TOOLS INEVERYSHOP. CHIBESLY& CO.
CHICAGO, ILL.U.S.A.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: I. The use of the cycle by persons in health. 2 The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1002. Price 10 cents. To be had at this office and from all newsdealers.

AMERICA'S FAVORITES.

Are Built in the Largest and Best Equipped Factory on Earth.

Our unequaled facilities enable us to supply better bicycles for less money than other makers can afford to market an inferior production, hence in purchasing a Waverley there is a clear saving of \$15.00 or more. A higher grade bicycle, it is impossible to produce. Our catalogue explains all. Send for it. INDIANA BICYCLE CO., Indianapolis, Ind.

• PLAY CARDS?



Send ten cents in stamps for a pair of our new **GAME** COUNTERS

INDIANA BICYCLE CO.

" IMPROVEMENT THE ORDER OF THE AGE."



Many Improvements Heretofore Overlooked by Other Manufacturers.

Address THE SMITH PREMIER TYPEWRITER COMPANY, Syracuse, N. Y. U.S. A. BRANCH OFFICES IN TWENTY-NINE PRINCIPAL CITIES IN THE UNITED STATES.



HARTFORD Single-Tube Tires are the standard single-tubes. Their success has caused a host of imitations. But who will have imitations when he can have the genuine?

IF IT'S A HARTFORD TIRE IT'S RIGHT.

The Hartford Rubber Works Co. HARTFORD, CONN.



The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St, opp. Duane, New York