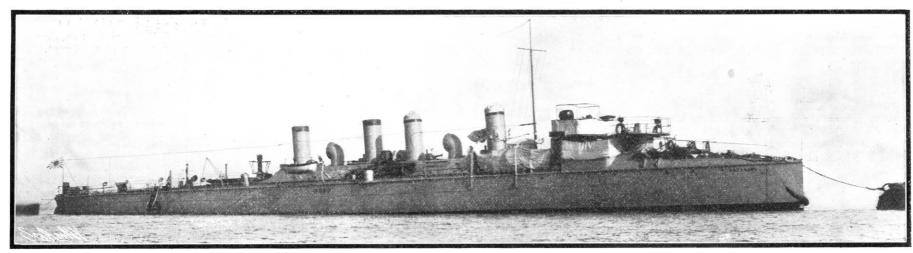
Vol. XC.-No. 11. ESTABLISHED 1845.

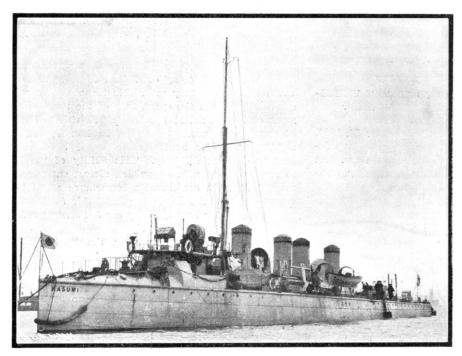
NEW YORK, MARCH 12, 1904.

S CENTS A COPY \$3.00 A YEAR.

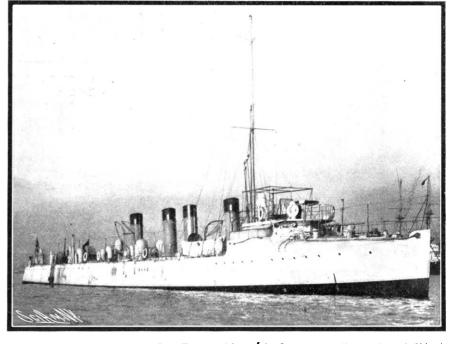


Length, 220 feet. Beam, 20.6 feet. Draft, 9.6 feet. Displacement, 360 tons. Speed, 31 to 31.4 knots. Armament: One 3-inch; five 6-pounders; two 18-inch torpedo tubes. Builder, Yarrow. Date, 1899.

"Sazanami." Class of Four Destroyers.

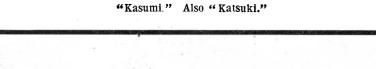


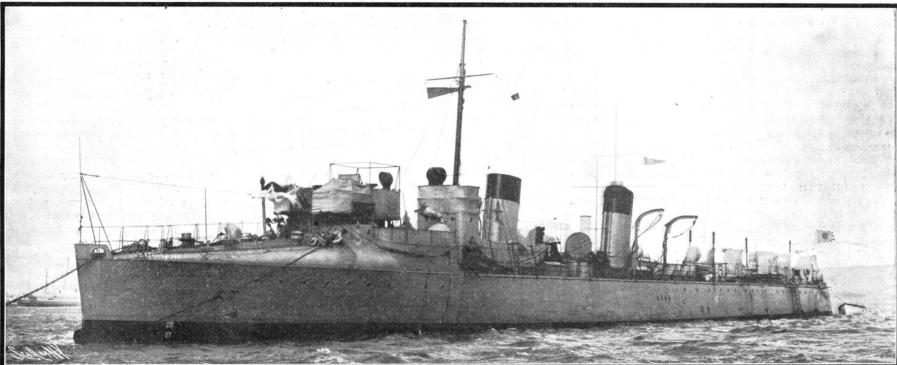
Length, 220 feet. Beam, 20,6 feet. Draft, 9,6 feet. Displacement, 360 tons. Speed, 31 knots, Armament: One 3-incn; five 6-pounders; two 18-inch torpedo tubes. Builder, Yarrow. Date, 1902.



Length, 216.7 feet. Beam, 20.7 feet. Draft, 8.3 feet. Displacement, 300 tons. Speed, 31 knots. Armament: One 3-inch; five 6-pounders; two 18-inch torpedo tubes. Builder, Thornycroft. Date, 1901-1902.

"Shirakumo." Also "Asashio."





Length, 210 feet. Beam, 19.5 feet. Draft, 7.2 feet. Displacement, 275 tons. Speed, 30 to 30.5 knots. Armament: One 3-inch; five 6-pounders; two 18-inch torpedo tubes. Builder, Thornycroft. Date, 1898-1900.

"Usugumo." Class of Six Destroyers.

## SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at No. 361 Broadway, New York

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845)...\$3.00 a year Scientific American Supplement (Established 1876)...\$5.00 a year Scientific American Building Monthly (Established 1876)...\$2.50
Scientific American Export Edition (Established 1876)...\$2.50
The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

### NEW YORK, SATURDAY, MARCH 12, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

#### THE DARLINGTON APARTMENT HOUSE DISASTER.

The fatal disaster to the Darlington Apartment House, in which, at the present writing, over fifteen persons are known to have lost their lives, is one more of those ghastly tragedies which seem to be necessary to stir up the public conscience to the point at which it sets resolutely about the removal or correction of some menace to the security of life and property. The stolid inertia of public opinion can be overcome apparently only when life is sacrificed by wholesale. Then we wake up demand reforms and to some extent get them. For proof of this it is not necessary to go beyond a radius of a quarter of a mile from the spot where they are at the present moment taking out the unfortunate victims of willfully careless tall building construction. Not much more than a stone's throw away is the site of the Windsor Hotel tragedy, the inmates of which offered their lives as the purchase price of a thoroughly drastic investigation of the question of fire-escape conditions in this city. Matters are better now than they were before the Windsor Hotel fire At least we hope they are Within a stone's throw of the Windsor Hotel site one may climb down into the tunnel of the New York Central Railroad Company, and on the easterly wall thereof, he will see the deep scars on the brickwork, which were made as the wreck of a coach, in which some score of unfortunates were crushed out of existence, was driven forward by the colliding engine. It needed apparently the sacrifice of twenty prominent business men of this city to set in motion the public sentiment which, in its turn, is bringing reforms in railroad management which will abolish forever the likelihood of a similar

The pile of wreckage with its entombed victims on West Forty-sixth Street teaches nothing new. Long before the falling of the building it was suspected that a considerable amount of "jerry" work was being done on the "bastard" steel structures, which are being run up continually in this city. We use the term "bastard" advisedly; for a structure that extends ten stories in height and depends for its rigidity upon the lugs and flanges of miserable, little, rectangular, cast-iron columns, has no rightful claim to the reputation for strength and security that goes with the term "steel construction." It was merely a question of time before on one or other of these structures a disaster such as this occurred. Buildings of the type of the Darlington are built purely for speculative purposes, and not a pound of material nor five minutes of time is going to enter into or be spent upon the construction of such buildings, more than is absolutely required by the laws of the Building Department. Moreover, the evidence of the building inspectors proves that in the case of this building, and doubtless of many others like it, there is a persistent effort to evade those rules of construction and erection which have been framed by the Building Department for the purpose of preventing just that very kind of disaster which has now happened. Unfortunately for the poor wretches who went down in the wreck, a flaw in the Building Department laws renders it impossible for the inspector to immediately stop construction on discovering faulty work. The law's delay between the making of such protests by the inspector and the stopping of the work is such that a contractor has some two weeks' grace before an injunction can be served.

As to the immediate cause of the wreck, it will be difficult to pronounce definitely until something more than a superficial examination can be made; but speaking broadly, it may be put down at once to faulty construction. It took but a single glance at the building by a representative of the SCIENTIFIC AMERICAN to satisfy him on this score. The cast-iron columns showed where they had been broken off, the seemingly inevitable blowholes. The maximum thickness of the shell of these columns at the street level appeared to be no more than the minimum allowed in any cast-iron column used throughout the whole building.

There is a sudden decrease in the section of the castiron columns of the front wall of the building from 10 or 12 inches at the street level to 6 inches on the first floor. What this line of columns had been reduced to by the time it reached the tenth floor is a matter of interesting conjecture. The connections appeared to have been all bolted, not a rivet being visible in the wreck of the iron and steel work.

We are of the opinion that the cause of the collapse was the lack of proper sway-bracing to keep the structure in its true perpendicular position, coupled, probably, with eccentric loading. The crying evil of castiron column work especially in a building of this kind, where the bending moments are very severe, is, that the whole work of resisting the bending, or what might be called shutting-up stresses of the steel and iron skeleton, is thrown upon the cast-iron connections at the columns, and upon the bolts by which the floor systems are tied to these columns. If the building is properly sway-braced as it goes up, and is stiffened by carrying up the brickwork and by putting in the concrete or tile floors close upon the heels of the erecting gang, the stresses upon these connections may be kept down within safe limits; but where as in this case, the haste, carelessness, ignorance, or greed of the contractor led him, in direct defiance of the warnings of the Building Department, to carry the steel and ironwork up far in advance of the brickwork, etc., and without putting adequate sway-bracing in this lofty work, it becomes easily possible for the stress upon the cast-iron connections to exceed the breaking strength, and precipitate a disaster.

The lessons to be learned are, first, that the building inspectors should be given the necessary authority to stop work on the instant, or at least within an hour or two, of their discovery of faulty and dangerous construction; and, secondly, that the limit of the height of building in which cast-iron columns are permissible should be greatly reduced, especially for that class of structure which is put up merely for speculative purposes.

#### REPORT OF THE ARMY BOARD AS TO THE USEFUL-NESS OF THE LAKE TYPE OF SUBMARINE BOAT FOR COAST DEFENSE.

Some weeks ago, in our issue of December 26, 1903, we published an account of the submarine torpedoboat "Protector," designed by Mr. Simon Lake. At that time the vessel was lying at Newport, R. I., awaiting trial by a naval board, but owing to ice in Narragansett Bay on January 12—the day set for the beginning of the trials—the board temporarily abandoned its work. A week later, with the water and weather conditions even more trying, an army board put the vessel through a series of maneuvers of a most convincing nature. The immediate result of the military examination of the vessel was an official report recommending the purchase of five submarines of the Lake type. That report, in turn, was referred to the General Staff of the army, and the General Staff has now added its confirmation to the recommendation of the examining board.

The examining board was composed of officers of the artillery corps, which now has control of the country's submarine coast defenses. These officers were Major Arthur Murray—senior officer of the School of Submarine Defense at Fort Totten, N. Y.—and his associates, Captains Charles J. Bailey and Charles F. Parker. These officers had likewise been detailed to watch the trials and performances of the submarines now in the navy, but they did not find those boats susceptible of military adaptation for coast defense. The "Protector," on the other hand, seemed to augur well for such service, and her performance on the day of trial, as well as the well-known sea-going record of the craft, are substantiation.

The military aspect of the question is summed up in the following particulars cited by the board; and, in passing, it may be said that this military view of the field of usefulness of the Lake submarine is quite coextensive with the widest field of service now contemplated by the navy.

## FOR DEFENSE.

First: To take the place of fixed mines, by lying adjacent to the forts and attacking vessels attempting to reduce the works or to run past, particularly in important channels where it is impracticable to plant mines, owing to deep and rough water, extreme width, or the swiftness of currents.

Second: To supplement fixed mines, by attacking vessels approaching the mine fields or those which have crossed them.

Third: To lie outside mine fields for scouting or picket duty, keeping in telephonic communication as hereafter described.

Fourth: To pick up and to repair defective cable joints, junction-boxes, etc.

## FOR ATTACK.

First: To run past the forts, and to attack vessels within the harbor.

Second: To drag for, pick up, and to cut multiple

and branch cables on the bottom, or mine cables leading to buoyant mines or buoys.

Third: To sweep the channel, two submerged boats being connected by a light cable extending across all or a part of the mine field.

To a very large extent, the board's attention was centered upon the diving compartment. This compartment is located in the bow of the craft, and is separated from the crew-space lying immediately abaft by an airlock; and both the diving compartment and the air-lock are fitted with air- and water-tight doors. The compartment is fitted with a connection to the low-pressure air system, and provided with a telephone communication with the living space, and a hydro-pneumatic gage with two hands, one of which registers the pressure of the water outside-due to depth-and the other the air pressure in the compartment. At the bottom of the compartment is an iron door, which can be opened outward. To open the door, the air-lock doors are first closed, and compressed air is admitted into the compartment until the gage hands indicate unity of air and water pressures. The door is then unfastened and allowed to swing open, thus giving, in clear water with the boat on the bottom, a good view of the sea bed.

This compartment provides for:

- 1. Mine cable cutting; or else repair of, or the burying of, mine cables and junction-boxes.
- 2. A channel for telephonic communication with the shore when the boat is on picket duty.
- 3. A way of escape for the crew, in case of the total disablement of the boat.

The board, remarking upon the ability of the "Protector" to run under gasoline propulsion with only the observing instrument and sighting-hood above water, said: "By reason of an automatic induction valve in the top of the sighting-hood, admitting air for the gasoline engines and excluding spray and water the engines may be used in this condition of submergence; and this fact gives to the boat a large cruising radius at comparatively high speed, and renders it likely that under many conditions of sea, light, and weather, the craft may get within torpedo range without being seen, in the event even of the total disablement of her electrical equipment. In this condition, of course, the omniscope would be housed, and the sighting-hood, of a neutral color, could be discerned only with great difficulty. This ability of the boat to run under gasoline propulsion almost entirely submerged assumes considerable importance when it is considered that the elements most liable to disability in the submarine boat of to-day are the storage battery and the electrical equipment."

The following quotation from the board's report gives the experience of its members:

The board was on board from 10:15 A. M. to 4 P. M. of January 19, 1904. From about 12 M. to 3 P. M. the boat was submerged, and from 12:40 to 2 P. M. the board was in the diving compartment, observing its operation and that of grappling for a cable.

No discomfort was experienced under the air pressure in the diving chamber, and the remaining part of the interior was quite as comfortable as any surface boat of its size would have been. Lunch was cooked and served while submerged.

## PROGRAMME.

- 1. Proceeded from Fort Adams (Newport, R. I.) some three miles up Narragansett Bay in cruising condition, using engines.
- 2. Passed from cruising to awash condition, housing all external fittings, except a wooden mast installed for the naval test.
- 3. Continued surface run in awash condition.
- 4. Passed to submerged condition by filling ballast tanks.
- 5. Maneuvered on the bottom of the bay, by using storage batteries and motors to propel the boat.
- 6. Filled diving chamber with compressed air, opened door in bottom, and, with a grapnel, picked up a telephone cable by moving slowly over its approximate position.
- 7. Passed from submerged to awash, and thence to cruising condition, and returned to Fort Adams by a surface run, using storage batteries and motors.

In passing from the submerged to the awash condition, it was found that an ice floe had drifted over the boat, which, on rising, broke through the floe and emerged with its deck completely covered with some eight inches or more of ice, which remained on deck while passing to the cruising condition. It was also found that the wooden mast above mentioned had been broken by the ice while the boat was maneuvering under it.

The weather was very cold (zero), the bay full of ice, and it would have been difficult to have chosen more adverse conditions for the test.

## CONCLUSIONS AND RECOMMENDATIONS.

## For Defense.

The board believes that this type of submarine boat is a most valuable auxiliary to the fixed mine defense, and, in cases where channels cannot be mined owing

to depth, rough water, swift tides, or width of channel, it will give the nearest approach to absolute protection now known to the board. The boat can lie for an indefinite time adjacent to the point to be defended, in either cruising, awash, or submerged condition by its anchors being upon the bottom. It is thus ready for instant use, practically independent of the state of the water, and in telephonic connection with the shore. It can also patrol a mined or unmined channel, invisible to the enemy, and able to discharge its torpedoes at all times. It possesses the power of utilizing its engines in every condition except the totally submerged, and can always charge its storage batteries while so doing, necessitating its return to shore only when gasoline must be replenished. In narrow channels the boat or boats would have a fixed position, with a telephone cable buoyed or anchored at the bottom. In wide channels they would patrol or lie in mid-channel, or where they could readily meet approaching vessels.

As a picket or scout boat, outside the mine field or even at extreme range of gun fire, telephone communication can be sustained, and information received and instructions sent for attacking approaching vessels.

The test at Newport demonstrated the ease with which the boat can locate and pick up cables and, with minor alterations in the present model, junction-boxes, etc., can be taken into the diving compartment and repaired at leisure while absolutely protected from hostile interference. The faculty possessed by the boat of maneuvering on the bottom and sending out divers, leaves little or nothing to be desired in its facilities for doing this work.

#### For Attack.

The boat shows great superiority over any existing means of attacking mine fields known to the board.

It can run by any mine field, as at present installed, with but little or no danger from the explosion of any particular mine or from gun-fire, durin the few seconds it exposes the sighting-hood for observation, and can attack at its pleasure vessels in the harbor.

The board personally witnessed the ease with which cables can be grappled, raised, and cut, while the boat is maneuvering on the bottom. Mine cables can be swept for, found, and cut, or a diver can be sent out for that purpose.

It should be noted that, with one exception, no seamen are needed aboard, this exception being the man who steers and handles the boat.

The crew is as follows: One navigator, who is also the diver; one chief engineer, one assistant engineer, one electrician, one machinist, one deck hand, one cook.

The board recommends consideration of the foregoing by the General Staff. The question of the use of the Whitehead torpedo as part of the fixed mine defense, fired from tubes on shore, is now receiving consideration. Where channels are wide and waters swift, this use of the Whitehead will be very limited. With boats of this type the Whitehead can, it is believed, be carried within certain effective range in all ordinary channels, and this, alone, will warrant the consideration asked.

The board recommends, in consequence of its conclusions, that five of these boats be purchased for use in submarine defense, as follows:

One for the School of Submarine Defense, for experimental work.

One for the eastern entrance of Long Island Sound.

One for the entrance to Chesapeake Bay.

One for San Francisco Harbor.

One for Puget Sound.

The necessity for this kind of defense in the four localities named, needs no demonstration, to those acquainted with them.

Narragansett Bay will be entirely free of ice in about four weeks, and then the naval board will try out the "Protector."

## RESULTS OF RECENT EXPERIMENTS WITH N-RAYS.

M. Blondlot has now succeeded in measuring the wave length of the new N-rays, and finds that the wave lengths are shorter than for light rays. In the first place, he shows that the rays are equally refracted by a prism. To study the dispersion and the wave lengths of the N-rays, M. Blondlot uses a method similar to that employed in the case of light. Prisms and lenses of aluminium are used, as this metal does not store up the rays like some other bodies. For the dispersion experiments, the rays are produced by a Nernst lamp inclosed in a sheet-iron box having an opening closed by an aluminium shutter. The rays are then passed through an inch thickness of pine, a second aluminium sheet and two thicknesses of black paper, so as to eliminate all other radiation. In front of the screens and at 6 inches from the burner is placed a large screen of wet cardboard, which cuts off all the rays except a beam passing through a slit 1-5 inch wide and 1.4 inch long, cut out of the cardboard. The beam falls on an aluminium prism whose refracting angle is 27 deg. 15 min. One face of the prism is perpendicular to the beam. With this arrangement, it is found that

several beams of N-rays are dispersed horizontally from the other face of the prism. To locate them, a narrow band of sulphide of calcium is moved about the region. Its increase in brightness shows the presence of the rays. Different beams were found and their index of refraction measured. These indices are 1.04, 1.09, 1.29, 1.36, 1.40, 1.48, 1.68, 1.85. To check up the results, the images of the burner were formed by means of an aluminium lens, measuring their distance from the lens. The latter (plano-convex) had a 2.6-inch radius of curvature. A 2-inch hole was made in the cardboard screen. The lens was placed at a known distance from the incandescent burner. and the image of the burner was explored by the phosphorescent screen. This method gave similar results for the indices of refraction of the different beams.

The next step was to measure the wave lengths of the various beams, and it was found, contrary to expectations, that these are much shorter than light With the above disposition, the beams obtained were quite distinct from each other. The beam to be observed is let fall on a second screen of wet cardboard having a narrow slit of 0.06 inch. To explore this narrow beam, an arm moving around a circular transit scale holds a vertical sheet of aluminium having a slit 1-400 inch wide, filled with the phosphorescent sulphide. Placed in the path of the beam, the exploring screen shows that the beam is narrow and uniform, and not accompanied by diffraction fringes. After this preparation, the beam is let fall upon a diffraction grating on glass (one of the Brunner pattern was used, ruled to 1-200 millimeter). The rays coming through the grating are explored by turning the phosphorescent screen through different angles, and it is found that a system of diffraction fringes exists, as in the case of light. However, the bands are closer together and are practically equidistant. This shows that the N-rays have much shorter wave-lengths than those of light. By rotating the exploring screen, the distance between the bands is measured. The angle of rotation is very small, and it is measured by a mirror and telescope, preferably between every tenth ray. From these distances and the ruling of the grating, the wave length is deduced by the usual formulæ. Different gratings gave practically the same wave-lengths, which are as follows for five of the beams:

lex of refraction.	Values of $\mu$
1.04	$\dots 0.00815$
1.19	0.0099
1.4	0.0117
1.68	0.0146
1.85	0.0176

The Newton's ring method was also used and gave similar results. These measurements show that the wave lengths of the N-rays are considerably shorter than those of light rays. It is a noteworthy fact that the wave length of the N-rays increases with the index of refraction, which is the contrary to the case of light rays.

In a paper recently presented to the Académie des Sciences, M. De Lepinay shows that the N-rays are produced by sonorous bodies in vibration. The fact that compression or bending of a body causes it to emit N-rays (as M. Blondlot found) led the author to suppose that sound vibrations should produce the same effect, seeing that a sounding body undergoes alternating strains which, although very slight, are, on the other hand, repeated many times per second. This was found to be true, using a phosphorescent screen to detect the rays. The bodies used were a tuning-fork, a bronze bell, and, especially, a large steel cylinder suspended by two cords and vibrating transversely from the blow of a hammer. The latter gave the best results. The phosphorescence increases on producing the vibrations, and diminishes progressively when the vibrations are suddenly stopped. It is found that the sonorous body is not the exclusive source of the N-rays, but also the air which surrounds it and transmits the vibrations. The air, in fact, undergoes alternate strains and forms a source of the rays. It is found that the action of the vibrating cylinder upon the phosphorescent screen still keeps up if a lead plate 0.1 inch thick or a screen of distilled water 1 inch thick is disposed so as to absorb all the N-rays coming from the vibrating body, without hindering the propagation of the vibrations to a point near the phosphorescent body Still more striking are the experiments made with a siren as the source of sound, as in this case there are no metal parts engaged in the vibration, this being produced by the air alone. The action on the phosphorescent sulphide is clearly observed when it is placed a little above the revolving disk. Seeing that the N-rays have the property of increasing the brightness of a body which is feebly illuminated, an interesting experiment is the following: The revolving disk of the siren itself is used as the illuminated screen, and it receives a dim light from a window at a distance, so regulated that none of the details of the disk can be distinguished by the eye. The disk having

been set in rotation beforehand, the experiment consists in passing the air through the siren and suppressing it again. Each time the air passes and the vibrations are produced, the disk appears with a stronger light, and at the same time the details are perceived, together with other parts of the siren. On stopping off the air, the whole goes back to obscurity. The effect is the same when the observer stops his ears, and it is not due to reflex action, as has been proved in different ways.

## EXAMINATION OF THE EMANATIONS GIVEN OFF BY RADIUM.

The fact that a part at least of the emanation from radium is transformed into helium is brought out in a striking manner by the recent researches of M. Curie and Prof. Dewar, which were presented to the Académie des Sciences.

A sample of 0.4 gramme of bromide of radium, pure and dry, had been left for three months in a glass bulb which communicated with a small Geissler tube and a mercury manometer. At the start of the experiment, a high vacuum had been made in the whole apparatus. During the three months, the radium salt gave off gas continuously at the rate of 1 cubic centimeter per month at atmospheric pressure. Spectroscopic examination of the gas by means of the Geissler tube showed only the presence of hydrogen and mercury vapor. No doubt a small quantity of water had been introduced into the apparatus at the same time as the radium salt, and it became decomposed gradually by the radium. The same sample of bromide of radium was taken to England and used in Prof. Dewar's laboratory at the Royal Institution for measuring the heat given off at low temperatures. In this case the salt had been transported in a quartz bulb provided with a tube of the same substance. A vacuum was made in the bulb and the quartz tube containing the salt was heated to redness, up to the fusing point of the salt. The gases given off by the bromide were collected by a mercury pump, and after passing through a set of U-tubes cooled by liquid air which condensed the greater part, the remainder of the gas was collected in a test-tube over mercury and examined by Prof. Dewar. The gases occupied a volume of 2.6 cubic centimeters at atmospheric pressure. They had brought over a part of the radium emanation and were radio-active and luminous. The light given off by the gases in the testtube, after three days' exposure with a photographic spectroscope of quartz, gave a discontinuous spectrum. It consisted of three lines coinciding with the three principal bands of nitrogen, 3,800, 3,580, and 3,370. During the three days, the glass tube had taken a deep violet hue, and half the volume of gas had been

When a spark was passed through the gas placed in a Geissler tube, the nitrogen bands also appeared in the spectroscope. Upon condensing the nitrogen in liquid hydrogen, a high vacuum was produced in the Geissler tube, and the spark showed the presence of nitrogen alone. The quartz tube containing the bromide of radium, melted and now deprived of all the occluded gas, had been sealed by the oxy-hydrogen blowpipe while a vacuum was made, and brought back to Paris. M. Deslandres examined it with the spectroscope about twenty days after the sealing of the tube. The gas inside the tube, illuminated by an induction coil using two rings of tin foil around the tube as the poles, was found to give the entire spectrum of helium. There were no other rays except those of helium after an exposure of three hours with a quartz spectroscope.

## A YEAR'S BATT LESHIPS IN ENGLAND.

During the past year fourteen vessels, excluding torpedo craft, were added to the British navy, representing a tonnage of 149,340 and an indicated horse power of 262,800. The list includes five battleships, all of the "Duncan" class. These vessels are of 14,000 tons, and are the fastest in the British navy, their speed being 19 knots. Seven new armored cruisers have been commissioned, with the result that the cruiser squadron has been strengthened, and is now not only the most powerful but the fastest fleet in the world, all of the ships having a full-power speed of 23 knots. The ships commissioned this year include the "Drake" and the "Leviathan," of 14.100 tons, with engines of 30,000 indicated horse power. The five other cruisers commissioned are the "Kent," "Bedford," "Monmouth," "Donegal," and "Berwick," all, with the first exception, built on the Clyde. These vessels are of 9,800 tons and 22 000 indicated horse power. The remaining two ships commissioned during the year were the sloops "Merlin" and "Odin." The armament of the ships may be regarded as indicating the power of attack, and thus it is interesting to note that this year's newlycommissioned ships had in all twenty 12-inch guns, four 9.2-inch weapons, 106 6-inch quick-firers, and 239 smaller weapons.

#### THE TYGARD RECIPROCATING-CYLINDER DOUBLE-ACTION GASOLINE MOTOR.

Our illustrations show very well the general appearance and constructional details of a novel gasoline motor that was exhibited by James W. Tygard, of Plainfield, N. J., at the recent Automobile Show. The inventor made use of a 3-horsepower de Dion motor as a basis for his new engine. He removed the cylinder of the former, and bolted to its crank case instead the square casing of aluminium that contains the reciprocating cylinder and its stationary piston. The upper portion of the new motor, which replaces the de Dion cylinder, consists of three parts-an outer casing bolted to the crank case, and containing at its lower end a slide for a cross-head; a stationary piston fitted with two rings at each end, and supported in trunnions in the center of the casing: and a long cylinder slotted on its sides in the center part, so as to be movable on the piston without interference from the trunnions of the latter. This cylinder is made up of two pieces of steel tubing of 1/8-inch wall, lapped together at the center of the piston, and held tightly to each other and their respective cylinder heads by six rods that pass alongside of them and through the heads. A cross-head is attached to the lower end of the cylinder, and this, together with the piston, acts as a guide for it. The connecting rod of the motor is fitted to a wrist pin in the crosshead.

The motor piston, instead of being flat at each end, is cupped out and fitted with exhaust, inlet, and spark ports opening from the round center chamber or valve seat, into each cylinder space. These ports are 90 deg. apart, and a glance at the end view of the piston in Fig. 4 will show them to the reader as white slits on each side of the center. By their use the gas enters and leaves the cylinder directly through the head, or through what corresponds to the head in an ordinary motor. The spark also occurs in this place, with the result that the quickest possible inflammation of the gas is obtained, while the full force of the explosion is obtained directly against the piston, with the least possible loss of heat. Within the center chamber of the piston is a rotary valve, that makes one revolution to every two of the motor crank shaft. This valve is a hollow shell, with ports and two central transverse partitions, that divide it into three chambers. One of these serves as an inlet and the other as an exhaust outlet, while into the middle one there extends a tube with two notches on its end, which, in conjunction with a stationary steel wire that rubs over the projections and falls into the notches, forms a reliable igniter of the simplest possible construction. The valve is slightly tapered, and is well lubricated by oil fed to it through tubes that lead to holes seen in the trunnions on each side of the piston (Fig. 4). Other oil pipes distribute oil on the sides of the piston, as shown in Fig. 2, while the cross-head is oiled by splash lubrication from the crank case. The rotary valve is turned by a Renold silent chain. It is readily removable, as is also the igniter. The latter can be taken out by unscrewing the two nuts on the upper end of the

valve stem. Fig. 3. The central steel wire, w h i c hhas its inner end bent somewhat like a fishhook, is  $c\ o\ n\ n\ e\ c\ t\ e\ d$ through the coiled spring on it to the wire from the battery. This spring also passes through a n insulated cross-piece connecting two studs. which are screwed into a movable collar on the right-hand end of the piston trunnion, a s shown in Figs. 2 and 4. The coil spring is stretched sufficiently t o keep the inner hooked end of the central igniter wire in contact with the notched

end of its tube. The wire is insulated from the tube by fiber bushings. A small metal piece seen on the wire just above the two nuts has a pin projecting from it. This pin contacts with a projection on one of the two studs, which keeps the igniter wire from turning. As the

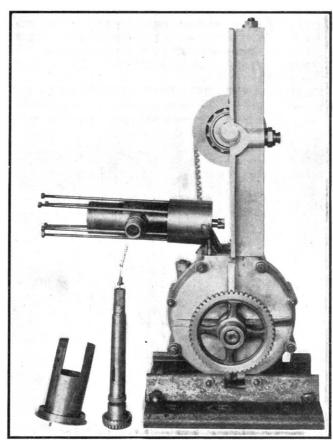


Fig. 3.—Motor With Half of Cylinder and Rotary Valve Removed.

notched tube containing the igniter wire turns with the valve, the wire, being held stationary, has the notches revolved against its hooked end, with the result that every time one or the other of the two notches wipes past it, a large primary-current spark ignites the charge in the proper cylinder space. The collar into which the studs are screwed is threaded on the trunnion, and by rocking it by means of the small handle,

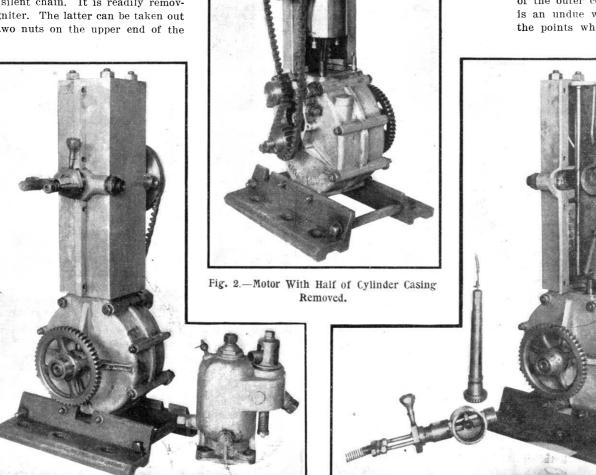


Fig. 1.—Tygard Motor Complete, With de Dion Cylinder Beside it.

Fig. 4.—Motor With Piston Removed.

In the end view of piston, which is seen in foreground, two slots indicate the valve ports.

the time of the spark can be varied. The cast-iron heads of the cylinder are U-shaped in cross section, and fit closely into the hollowed-out piston when compressing a charge. Compactness is gained by this arrangement, besides very little of the cylinder wall being ex-

posed to the hot, burning gases. The cylinder wall is perforated in the center portion, which is never off the piston, in order to aid in cooling the latter. This is accomplished by the pumping action of the rapidly-moving cylinder drawing in air and expelling it at every stroke, as well as by the suction of the air for the carbureter, which is taken from around the piston through the pipe coming out from the trunnion on the sprocket side of the casing. The pipe on the other or front side (Fig. 1) is that for the exhaust. The inlet pipe is connected to the center of the rotary valve on the sprocket end. The valve is of cast iron turning in a steel casing, and having 1-16-inch end play. The single stationary, double-ended piston is well shown in Fig. 3, where the two packing rings are visible at the end of the piston, disclosed to view by the removal of the upper half of the cylinder. The bore of the cylinder is 23/4 inches, and its stroke is 35-32. The power of the motor has been about doubled, with the addition of one-fifth its weight. The total weight at present is 120 pounds.

The motor operates on the regular four-cycle principle, two impulses one-half revolution apart being obtained every other revolution. The air cooling is effective on this sized motor; while another valuable feature is that by opening a cock in the upper cylinder head, which can be done while the motor is running, it can be run on the lower cylinder only, thus developing but half its power, and running at half its regular fuel consumption with full compression in one cylinder. The rotary valve forms a positively-actuated valve of the simplest possible construction, the wear of which will be little or nothing, as it practically runs in oil. This type of valve advantageously re-

places a suction-operated inlet valve and a mechanicallyoperated exhaust valve, since it does away with the throttling effect of the former, and saves the power lost in raising the latter against the exhaust pressure. Its rotary action is noiseless at all speeds. A company is being incorporated to manufacture this motor at Plainfield, N. J.

Automobilists if they desire to be rendered free from tire troubles should see that their tires are properly and fully inflated, as many of the troubles experienced in this direction are to a great extent attributable to insufficient inflation. The object of a pneumatic tire is to support the weight of the vehicle acting on the rims of the wheels upon a cushion of compressed air. If, therefore, a tire is not fully inflated, the weight instead of being supported upon the compressed air, is borne by the rim, and the tire is consequently jammed between the ground and the rims of the wheel, with the result that it is rapidly destroyed. The edges of the outer cover of the tire are cut away, or there is an undue wear upon the external rubber layer at the points where the latter comes into contact with

the edge of the rim and the inner tube. The latter is consequently being nipped c o n tinuously, with the result that it is soon punctured with a number of minute holes and is quickly decomposed. A fully inflated tire, on the other hand, affords a thick cushion of compressed air between the rim of the wheel and the ground, and although the outer covering may be worn away through friction with the road, the inner tube is preserved, while greater comfort and ease in riding are obtained.

## THE DEVELOPMENT OF THE HIGH-SPEED LAUNCH OR AUTOMOBILE BOAT.

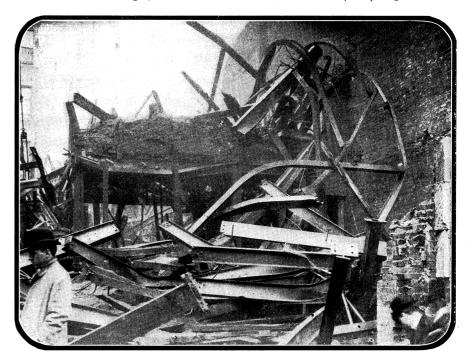
Our illustrations show two new motor-boat hulls designed recently by Mr. Sutphen Sutphen, and built by the Electric Launch Company, of Bayonne, N. J.,

the French automobile boat was but a lighter and speedier type of the standard American launch, such as has been in use here for more than a decade past. In fact, some of the automobile boats were simply American launches, such as the Lozier and the Eagle,

craft in this country, and the hulls illustrated herewith are two of the latest to be built in America.

The F. I. A. T. hull, which is shown lifted by three men, weighs but 550 pounds, and its weight complete, with motor and accessories fitted, is 1,300 pounds. The





Looking Northwest, Showing the Westerly Wall.

Looking Northeast, Showing Easterly Wall.

Note in foreground of both views the broken flange bolted to base of overturned cast iron column. The mottled effect is due to the honeycombed condition of the flange. In its fall the building lunged against the tall building seen to the rear, scoring the brickwork and sweeping down the fire-escapes. The wreck is discussed in our editorial columns.

## THE DARLINGTON APARTMENT HOUSE DISASTER, NEW YORK CITY.

one for the American branch of the Paris firm of Panhard & Levassor, and the other for Hollander & Tangeman, the American representatives of the Italian F. I. A. T. motors and automobiles; while the line cut gives a longitudinal section, plan view, and transverse sections of a speed launch designed, built, and run successfully last summer by Mr. C. D. Mower, the official measurer of the New York Yacht Club and the editor of "The Rudder."

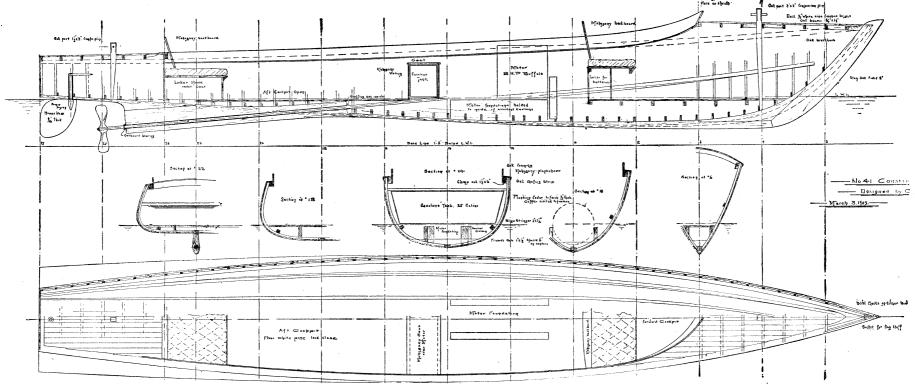
When, last summer, French automobile enthusiasts organized an automobile boat race from Paris to the sea, and carried out the same successfully on the quiet waters of the Seine, Americans recognized, from the pictures and published reports of the participants, that

which participated in the cruiser class. The English Napier 40-foot automobile boat, fitted with a 75-horse-power motor, won from a French boat, fitted with a German Mercedes motor, in a race held at Trouville after the termination of the former races. The Napier boat had previously covered  $8\frac{1}{2}$  miles in 24 minutes, 44 seconds, in the race for the Harmsworth trophy in Queenstown harbor, as illustrated in our issue of August 8, 1903; and it beat the Mercedes 10 1-5 seconds in a mile race, its time being 3:30 3-5, which is equivalent to a speed of 17 1-3 miles an hour. It also won from this boat in a 3-mile race.

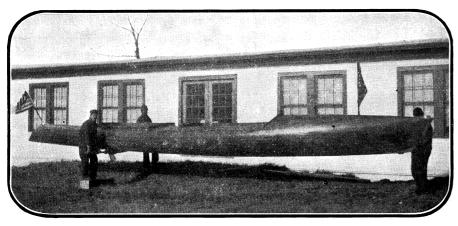
The success of the motor boat abroad led importers of foreign automobiles and motors to build such speed

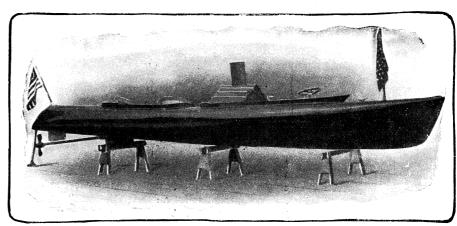
hull is 35 feet long by 4½ feet beam; and it is built of two layers of narrow, thin planking, the outer layer, of mahogany, running horizontally, and the inner one, of cedar, diagonally. The two layers have a sheet of specially prepared, very thin canvas between them, and they are riveted together by 20,000 small copper rivets. A 24-horse-power F. I. A. T. motor of 130 millimeters (5.118 inches) bore and stroke and capable of a maximum speed of 1,100 R.P.M. drives the propeller shaft through a regular automobile cone clutch. The propeller is a three-bladed one, of 36 pitch.

A general idea of the lines of the peculiarly shaped hulls of these two boats is to be had from the cross sections of Mr. Mower's boat, the "Express," which are



Inboard Profile, Sections, and Plan Views of the High-Speed Launch "Express."





A 35-Foot Automobile Boat Hull Lifted by Three Men.

A Typical Automobile Boat Fitted with a 15-Horse-Power Motor.

shown in the annexed diagram, while the general arrangement of all boats of this kind is also to be noted in the longitudinal section and plan views. As the five cross-sections of the hull of the "Express" clearly show, the bow is of a very sharp V section so as to cleave the water easily, while this sharp V section is modified and made rounding toward the middle of the boat, and changes gradually to an extremely flat U section at the stern, so that the after body, with its decreasing draft, slides on the surface of the water. The hull of the F. I. A. T. boat, besides being flat, tapers upward at the stern sufficiently to clear the water line for the last four feet of its length when the boat is at rest. When the boat is in motion, however, its stern rests on the water, and its total water line is then 34 feet. The hull draws but 8 inches of water, the point of greatest draft being at the bow. This boat is to race the "Vingt-et-un"—the Smith & Mabley 31-foot racing launch equipped with a four-cylinder 3 13-16 x 51/2 American-built Mercedes motor, and a 16-inch threeblade propeller of about 28 pitch—for a valuable cup trophy. The "Vingt-et-un," it is claimed, made a mile on the Hudson River, on November 5 last, and with the wind and tide, in 2 minutes, 26 seconds. She is rated at 18 horse power, but her builders declare she will develop 22. Her weight complete at the time of the trial was 850 pounds. The lines of this boat are more like those of the regular launch than those of the automobile boats here shown.

The Panhard boat consists of a complete French auto boat equipment in an American hull. The hull is built upon a light oak frame, which is double planked with elm and mahogany, the latter being used on the outside. The 15-horse-power, 91 x 130 millimeter (3.582 x 5.118 inch), four-cylinder motor is placed just ahead of the center of the boat, with the operator's seat in front of it. A regular automobile inclined steering wheel is provided. On each side of the operator is a long vertical lever extending upward from the floor of the boat. One of these operates the cone clutch back of the motor, by which the propeller shaft. with its two globular universal joints, may be disconnected, while the other reverses the propeller blades for reversing. Attached to the boat on each side of the steering wheel is a small handle that moves over a notched segment. One of these handles controls the spark and the other the throttle. The motor is fitted with the Krebs automatic carbureter (described in our issue of February 14, 1903), and it is in every respect like the regular automobile motor. A horizontal exhaust chamber is fitted just below the smoke stack. and the exhaust gases pass out of the latter. This is the arrangement used in France, instead of conveying the exhaust through a pipe passing through the hull and into the water. The rear cock-pit has luxuriously upholstered individual seats capable of accommodating six persons. The boat is expected to make  $17\frac{1}{2}$ miles an hour at 750 R.P.M. of the motor. As the latter can be speeded up to 1,200 R.P.M., the boat should be good for spurts of 20 miles an hour or over. This speed, which seems to be the average aimed at, was exceeded a year and a half ago by a 55-foot, 120-horsepower launch designed by Mr. H. T. Leighton, of Syracuse, N. Y., and run on Oneida Lake at a speed of 23 miles per hour over a mile course that had been measured on the ice and staked off when the lake was frozen. Mr. Leighton had built several fast launches previously, and had had the benefit of a good deal of experience with this type of boat. The particular launch in question was 55 feet over all and on the water line, 7% feet beam on deck, and 6½ feet beam on the water line. She was of the regular launch type, with a torpedo-boat stern, and her engine was an eightcylinder one of the two-cycle type. This boat, therefore, is the fastest small craft that has yet been built, and her engine is probably the first eight-cylinder gasoline engine to be constructed in the world. Thus it appears that America still holds the palm in the matter of fast launches.

Another launch of this type that has made very fast speed in and around New York harbor, is the "Standard," a 58-foot boat having a regular torpedo-boat hull fitted with an 8 x 10, six-cylinder, slow-speed, Standard marine motor. Despite the fact that the double planked hull of 3-16-inch mahogany warped badly between the timbers, thus making the bottom of the hull corrugated instead of perfectly smooth, this boat made the fast time of 21 miles an hour. The hull is being rebuilt, and the builders hope to exceed this speed considerably in the near future.

Among the motor boats exhibited at the recent Sportsmen's Show in Madison Square Garden was the "Dolphin II.," which was designed by Mr. Graef after experiments last summer with a smaller, 25-foot model. The latter boat, driven by a single-cylinder, two-cycle motor, running at 830 R. P.M. made over 13 miles an hour without producing any side or stern waves. The hull is built on the wedge principle, tapering from a sharp V section at the bow to a straight, horizontal line at the stern, the bottom not rounding in the least. The "Dolphin II." has an over-all length of 31 feet,

8 inches; a length on the water line of 30 feet; a beam on deck of 4 feet, 2 inches; and a beam on the water line of 3 feet, 10 inches. The weight of the four-cylinder, 25-horse-power, Standard motor and reversing gear in this boat is 510 pounds, and that of the hull, 564 pounds. The total displacement, with crew aboard, is 1,770 pounds. Judging from the speed attained with the under-powered "Dolphin I.," the new "Dolphin" should be very fast. In the limited space of the tank at the Sportsmen's Show, she has already shown a speed of over 16 miles an hour.

Other firms that are building automobile boats, and that exhibited high-speed, four-cylinder, automobile type motors for the same at the Sportsmen's Show, are the Lozier Motor Company and the American Darracq Company. The former company now has under construction a 25, a 36, and a 37-foot boat of this type, fitted with its  $4\frac{1}{2}$  x  $5\frac{1}{2}$ , 24-horse-power motor; and the latter is fitting up a 32-foot hull designed and built by Herreshoff, with a  $3\frac{1}{4}$  x 4-inch, 20-horse-power engine.

The above description of some of the automobile boats, or high-speed launches, that have been built in this country, shows how the desire for rapid pleasure boats by men of wealth, stimulated by the use of modern and speedy automobiles, has caused the designing of a new type of craft which has been made possible by the development of the high-speed, light-weight automobile motor. In fair weather, this new type of boat may yet be used for business as well as for sporting and pleasure purposes, and it will doubtless open a new era of speed on the water, such that the largest and speediest boats afloat may have to look well to their laurels.

#### THE JAPANESE DESTROYERS.

Never, surely, in the history of strife upon the sea did an engine of destruction justify its name with such terrible emphasis as when the Japanese torpedo-boat destroyers made their ever-memorable attack upon the Russian fleet at Port Arthur, and in a few minutes time put out of action two modern battleships and one of the finest protected cruisers afloat. Practically no particulars of the fight, or rather of that special part of it that fell to the lot of the torpedo-boat destroyers, have reached us, and it may be several weeks. if not months, before we are authoritatively told in what formation and using what particular tactics the destroyers made their bold raid upon the Russian fleet. According to present accounts, they dashed into close quarters and came within such short range that they could not well miss their mark. The puzzling feature. if this be true, is that the boats should have been withdrawn practically unscathed; for it is a pretty generally accepted maxim that the torpedo boat that comes so close as to make perfectly sure of its quarry is equally sure of paying the penalty of its own destruction. If the attack was made at short range, the immunity of the destroyers could only be explained by the probable fact that in ignorance of the imminence of war the officers were ashore, the crew in their hammocks, and only an ordinary peace-time watch was being kept. In such case, it would be possible for the torpedo boats to make the circuit of the battleships and escape before the gun detachments could reach their stations and open fire with any kind of accuracy.

On the other hand, it is quite possible that the Russian fleet, being anchored near the harbor entrance, was rather closely bunched together. The destroyers may have discharged their torpedoes at a long range of say 2,000 yards, and simply directed a stream of them into the fleet, with the certainty that although some might pass through, other torpeloes would be sure to find a mark.

The Japanese fleet of destroyers, like the rest of their navy, is brand new, and embodies the latest ideas of the two leading torpedo-boat builders of the world-Thornycroft and Yarrow. The oldest of their boats, represented by the destroyer "Usugumo," is not more than five years old. The "Usugumo" is one of six similar vessels built by Thornycroft at Chiswick, England, and launched in 1898-1900. The dimensions are as follows: Length 210 feet, beam 19.5 feet, and draft 7.2 feet; displacement, 275 tons. The speed of these six vessels varied from 30 to 30.55 knots per hour on trial. Each is armed with one 12-pounder rapid-fire gun, mounted forward, and five 6-pounders. They carry a complement of fifty-four officers and men, and have a coal capacity of 80 tons. These halfdozen Thornycroft boats are distinguished by having two large elliptical funnels, most of the other Japanese destroyers having four smaller circular funnels. Each boat carries two 18-inch torpedo tubes.

In 1901-1902, Thornycroft launched for the Japanese government two other destroyers, named respectively "Shirakumo" and "Asashio." They are larger and more powerful boats, 216.7 feet in length, 20.7 feet in beam, and with a draft of 8.3 feet and a displacement of about 300 tons. Twin engines of 7,400 horse power drive them at a maximum speed of 31 knots an hour. The armament is the same as that of the six

boats above described. The contribution of the Yarrow firm at Poplar, London, to the Japanese navy is seven destroyers of the following dimensions: Length 220 feet, beam 20.6 feet, draft 9.6 feet, and displacement about 360 tons. With 6,000 horse-power these vessels have shown speeds on trial of from 31 to  $31.62\ \mathrm{knots}$ an hour. They carry the same armament of one 12pounder, five 6-pounders, and each mounts two torpedo tubes. The latest of these are the "Kasumi" and "Akatsuki," both of which were launched in 1902. They carry 95 tons of coal and a complement of fifty-five officers and men. All of these vessels have four funnels and a single pole mast forward. The Japanese themselves launched in 1901 at Yokosuka four destroyers of the same dimensions and speed as the last-named Yarrow boats, and these are at the present time believed to be all in commission, making a total of nineteen destroyers.

In closing our description we would say a word with regard to the seaworthiness of these ships. Popularly they are supposed to be suitable only for use in quiet seas and practically calm weather. As a matter of fact, in their long journey from England to the Orient, they showed remarkably good sea-going qualities. This is due largely to their increased size over early torpedo boats, and to the generous freeboard that each of them, as can be noticed from our photographs, possesses. Of course, in heavy weather it is necessary for these boats to slow down to a lower speed than would be required in the case of gunboats, scouts, or small cruisers, and it is in recognition of this fact that the navies are beginning to build vessels of the scout type possessed of an extremely high speed, the most celebrated representative of this class being the Russian cruiser "Novik," which, with a displacement of 3,000 tons, has a speed of 26 knots an hour. It is probable that in rough water the "Novik" would be able to overtake, and destroy with her 4.7-inch guns, any destroyer that she might sight in the open.

#### The Pele Club.

The Pelé Club, which is an organization comprising the newspaper and magazine correspondents and artists, the army and navy officers and the scientists of the United States who went to Martinique directly after the great eruptions of May, 1902, held its second annual meeting at the New Willard Hotel, Washington, D. C., on Saturday, February 27. The members of the club, now about eighty in number, are scattered all over the world, so that the attendance at the meeting, though small, was considered very good and those present made up in enthusiasm what they lacked in numbers.

Prof. Robert T. Hill, the president of the club, in the course of his remarks in opening the session, spoke of the large amount of information regarding the characteristics of explosive volcanoes which had been assembled through the efforts of the members of the club. One feature of the record is the great number of photographs taken which have permanent value through the many geological and human phases of the phenomena which are thus preserved. About 1,500 such negatives and prints have been assembled at the American Museum of Natural History which are accessible to all the members. President Hill advanced the proposition that the time was ripe for the expansion of the Pelé Club from the nucleus already in existence so as to include all persons interested in the scientific study of volcanoes and vulcanology. There is no society in this country having for its primary object the study of volcanoes, in spite of a wide interest in the subject. The idea was received with favor and the organization of the new society will be pushed vigorously.

The club has in course of preparation and expects to issue this year a book upon the eruptions, which will be the composite work of many contributors relating largely personal experiences. Dr. E. O. Hovey, the chairman of the editorial committee, reported that chapters had already been submitted by Major H I Gallagher II S A of the general staff on the organization of the United States relief expedition and the assembling of the stores; by Lieut. Commander J. B. Barnadou, U. S. N., on the nature of the exploding cloud; by Prof. Israel C. Russell, of the University of Michigan, on the contributions to the science of vulcanology resulting from the study of the eruptions; by Prof. Robert T. Hill, formerly of the United States Geological Survey, on the geo logical history of the Caribbean islands; by August F. Jaccaci, formerly of McClure's Magazine, on Pére Mary, the brave parish priest of Morne Rouge, the real hero of the time; by H. H. Smith, relating how the correspondents did their work; and by other members of the club, relating personal experiences or contributing scientific observations.

During the evening Dr. Hovey related the history of the wonderful spine which rose above the top of the new cone of eruption and dominated the mountain from October, 1902, to July, 1903, full description of which appeared in the Scientific American

and Supplement for December 5, 1903. He also brought the description down to date.

After the destruction of the slender spine in the latter part of July and the early part of August, 1903. the "dome" of the new cone rose bodily until it had regained a large part of the height lost by the spine. Then after the great activity of September, 1903, had lessened, the dome was seen to be altering its contour from day to day, the southwestern side of the top being blown away by the numerous small eruptions, leaving a pronounced narrow ridge along the northeast side of the top of the new cone. In December this showed an almost overhanging face toward the southwest, while a new spine or obelisk was becoming prominent on the site of the earlier one. In January, 1904, the reports state that the new cone presented a double summit, the one very sharply conical and the other jaggedly turreted. There is but little activity now, though steam rises copiously from time to time, and an occasional "dust-flow" descends upon the upper portion of the Rivière Blanch; gorge.

The slopes of the mountain which were protected from the fury of the volcanic hurricanes are now thickly covered with grass, and the greater part of the town is green, too. Comparatively few walls are standing, and the site of St. Pierre looks like a plowed field

The officers of the club are: President, Prof. R. T. Hill, geologist, and secretary, Mr. H. H. Smith, of the Washington bureau of the World. The next meeting will be held in New York in the fall.

#### The Commercial Far East.

"Commercial Japan in 1904," "Commercial Russia in 1904," "Commercial Korea in 1904," and "Commercial China in 1904" are the titles of monographs just prepared by the Department of Commerce and Labor through its Bureau of Statistics. These monographs, which discuss commercial and other conditions in the countries in question, are now in the hands of the printers and will be published as a part of the Monthly Summary of Commerce and Finance, a portion in the issue to be made within a few days, and the remainder in the issue at the close of the present month. They discuss commerce and commercial conditions in each of the countries in question, not only at the present time, but the history of their commerce, their trade relations with the various parts of the world and with each other, the total value of their present commerce compared with that of earlier years, their trade with the United States, with other leading countries of the world, and with each other. Many other important facts regarding conditions in those countries are also discussed, such as railways, telegraphs, routes of communication, manufacturing industries, the class of merchandise imported, and the class of merchandise

The total commerce of the territory fronting upon and immediately adjacent to the scene of present hostilities aggregates, in round terms, about \$600,000,000, of which considerably more than one-half is imports. Japan's commerce is about equally divided between imports and exports, but in the case of China and Asiatic Russia imports greatly exceed exports, and this is also true of Hongkong, which passes most of its imports on into China and draws from China most of the articles which become its exports. Probably three-fifths of the total commerce of the countries in question, taken as a whole, is in the form of imports, and the United States is year by year supplying a larger share of those imports of the countries in question and gaining upon other countries in the relative share which it supplies thereof. Of the exports from the countries named, the United States is the largest single purchaser. The tea, the raw silk, the manufactured silk, the rice, the mattings, and other products of this character which form the bulk of the exports of China and Japan go more largely to the United States than to any other single country of the world, as to Asiatic Russia and Korea their ex ports are at present so small as to be of little importance in a discussion of the commerce of the countries in question.

The more important of the exports of the United States to the section in question are cotton and cotton goods, kerosene, flour, lumber, manufactures of iron and steel, manufactures of leather and tobacco. Raw cotton exported to this particular section of the world goes chiefly to Japan, and the market in Japan for American cotton is influenced largely by the surplus of cotton in India, which is of shorter staple and therefore of lower price. In years of short supply in India Japan turns to the United States for its raw cotton, but in years of plentiful supply in India a large proportion of the raw-cotton purchases of Japan are the product of India. In cotton manufactures China is the most important customer. The exports of cotton manufactures to China in the past year have materially fallen off, though the reduction in imports of American cottons into China is no greater proportionately than the reduction in such imports from other countries. This reduction in importations of cotton goods into China is due in part to the unsettled conditions which have prevailed during the year, and in part to the increased importations of cotton yarn and increased domestic production of cotton goods.

Kerosene is an even more important item in our exports to the Orient, and in this article the trade is barely holding its own, kerosene from Russia and Sumatra proving a very active competitor. To China the exports of mineral oils from the United States fluctuate greatly, ranging all the way from 20 to 55 million gallons per annum. In 1901, for example, the total was 27 million gallons; in 1902, 57 millions, and in 1903, about 20 millions. To Hong-Kong the shipments are more steady, ranging from 15 to 18 million gallons per annum. To Japan the shipments also fluctuate in some degree, though not so greatly as in the case of China. In 1899 the total to Japan was 32 million gallons; in 1902, 59 millions, and in 1903, 35 millions.

Flour as a factor in our export trade to the Orient has of late attracted coniderable attention, but the total is not large, nor the growth rapid. The total value of flour exports to the Orient from the United States in the last fiscal year was: To Hong-Kong, \$4,628,224; to Japan, \$2,247,199; to China, \$289,637, making the total to the countries under consideration \$7,165,060, or less than 10 per cent of the total exports of American flour in 1903.

### The Mystery of Worlds.

"Few people need to be told that a rotating fluid mass is shaped very much like an orange," says Miss Agnes M. Clerke, writing in Knowledge on "The Fission of Rotating Globes." "It assumes the form of a compressed sphere. And the reason for its compression is obvious. It is that the power of gravity, being partially neutralized by the centrifugal tendency due to axial speed, gains progressively from the poles, where that speed has a zero value, to the equator, where it attains a maximum. Here, then, the materials of the rotating body are virtually lighter than elsewhere, and consequently retreat furthest from the center. The 'figure of equilibrium' thus constituted is a spheroid, a body with two unequal axes. other words, its meridional contour—that passing through the poles—is an ellipse; while its equator is circular. Now we know familiarly, not only that a spinning sphere becomes a spheroid, but that the spheroid grows more oblate the faster it spins. The flattened disk of Jupiter, for instance, compared with the round face of Mars, at once suggests a disparity in the rate of gyration. But there must be a limit to the advance of bulging, or the spheroid, accelerated ad infinitum, would at last cease to exist in three dimensions! Clearly this unthinkable outcome must be anticipated; at some given point the process of deformation must be interrupted. A breach of continuity intervenes; the train is shunted on to a branch line. Nor is it difficult to divine, in a general way, how this comes to pass. Equilibrium, beyond doubt, breaks down when rotation attains a certain critical velocity, varying according to circumstances, and the spheroid either alters fundamentally in shape, or goes to pieces. So much plain common sense teaches; yet the precise determination of the course of events is one of the most arduous tasks ever grappled with by mathematicians. M. Poincaré essayed it in 1885; it was independently undertaken a little later by Prof. Darwin; and the subject has now been prosecuted for eighteen years, chiefly by these two eminent men, with a highly interesting alternation of achievement, one picking up the thread dropped by the other, and each in turn penetrating somewhat further into the labyrinth."

## The Current Supplement.

Mr. Waldon Fawcett opens the current Supplement, No. 1471, with a well-illustrated, instructive article on the manufacture of emery wheels. Mr. Charles Stevenexcellent paper on whale oil is concluded. The Baltimore fire was made the subject of a careful study by Mr. F. W. Fitzpatrick. His conclusions are published in the current number of the Supplement. "A Capture of Elephants at the Kraal of Ayouthia, Siam," is the title of a descriptive article that will surely be of interest to many readers. The building of Harbin is described in a paper on the conditions in Manchuria by United States Consul Miller, of Niuchwang, China. The behavior of selenium with regard to light and temperature, a subject which has been of considerable importance to physicists ever since the invention of Prof. Bell's radiophone, is recounted in a brief but valuable discussion.

A yield of 5 cubic feet of acetylene gas from every pound of calcium carbide is guaranteed by manufacturers in the United States. In Germany acetylene gas is mixed with a gas of lower candle power, containing about 25 per cent acetylene, and used in railway cars.

## Correspondence.

The Origin of the Sheepeater's Monument.

To the Editor of the  ${\tt Scientific}$   ${\tt American}$  :

I have noted with interest your illustration, in your issue of February 13, of "Sheepeater's Monument" in Idaho, with its accompanying article; but the writer of the article does not seem to have made it very clear precisely how the column was formed, which he ascribes to the action of "wind and weather." In fact, he explains its origin in the following language: "At first a cloudburst, possibly, formed a channel; this became a canon, and as the sides of the mountain washed away, a column-shaped mass, which was more resistant and harder than the rest, was left. Accident made the top of the column larger, as chance shaped the lower portion."

The author of the paper thus apparently regards the stone capping of the column as a mere incident having nothing to do with the formation of the column. May I be permitted to say, this is an explanation which does not explain. Besides, it is not easy to see how "a column-shaped mass harder than the rest," and positioned exactly vertical to the horizon, could have existed in the original mass from which the column was formed.

From the published photograph and description it seems to me clear that the column is the work of rain, and of rain only; and that wind, and, in a general sense, "weather," had nothing to do with it; and that so far from the capping-stone being an accident, the column owes its existence to it. Such stone-capped pillars are found in greater or less degrees of perfection in various parts of the globe, especially in meuntainous districts; they are, I believe, always found in unstratified material containing bowlders or flat stones, always on the flanks of ravines, and always taper toward the top. In several ravines near Botzen in the Tyrol (southern watershed of the Alps) are found hundreds of such columns consisting of indurated mud containing bowlders, varying in height from 20 to 100 feet and usually capped by a single stone. Their mode of formation is described by Lyell in "Principles of Geology," I., 331, and a diagram shows the outline of an original valley excavated in red porphyry, and partly refilled by a glacial moraine, comprising hard, red mud containing bowlders. This mud, after a rain being heated by the sun cracks; succeeding rains enlarge these cracks to furrows, and the furrows to gullies, till the material is cut up into a series of columns or pillars. The tops of these pillars are gradually worn off by succeeding rains, until a stone is exposed, which protects the material immediately beneath it, and thus the column is carved out, beginning with the top, so to speak, and becoming longer and longer as the unprotected mud is washed away on all sides. Some are found where large flat stones appear resting on a mere point, giving an umbrella-like appearance; in others the stones have fallen off and the column then wears away rapidly, until, perhaps, another stone is reached which for a while prevents further disintegration. The upper part of the column is always thinner than the lower part, because it has been longer exposed to the action of the rain. Further, the sectional contour of the pillars conforms to that of the capping-stones, and they are therefore like the "Sheepeater's Monument," more often pyramidal than conical.

I have inclosed you a sketch (from the same source) of the "Dwarf's Tower" near Viesch in the canton of Valais (Switzerland), composed likewise of hardened mud and gravel, and capped by angular blocks of gneiss.

I judge that the "Sheepeater's Monument" consists of a similar mixture of indurated clay and gravel and that it is the remnant of a glacial moraine which formerly filled the valley to a point above the level of the capping-stone and in which moraine the existing ravine has been scooped.

As to the senseless name "Sheepeater's Monument"—it would be interesting to know if it were not originally named by its discoverer after Jupiter, whose appellation was subsequently corrupted by the natives into something they could understand.

GEORGE W. COLLES.

Milwaukee, February 23, 1904.

It not infrequently happens that, in any new development, some minor detail gives more trouble than all the rest of the apparatus. In this respect, automobiles are notably weak in two points. Tire troubles are probably responsible for the greatest number of breakdowns, and the tire itself requires constant watching and care. The other weak point is the apparent lack of an entirely reliable igniter. At the recent motor car trials, held in London, England, in September, under the auspices of the Automobile Club of Great Britain and Ireland, no fewer than forty-one per cent of the cars that stopped did so on account of trouble with ignition.—Electrical Review.

#### TWO INTERESTING ANIMALS AT THE NEW YORK ZOOLOGICAL PARK.

The popular name snow leopard seems almost to involve a contradiction of terms, for leopards, as well as lions and tigers, have always been associated in the minds of most of us with the torrid zone. The popular idea, however, that the larger species of wild animals belonging to the cat kind are confined to the tropics is an essentially mistaken one. Our own big cat, the puma, for example, is at home at least as far north as British Columbia, and extending through every variety of climate, lives as far south as the frigid extremity of Patagonia, thus possessing perhaps the most extensive longitudinal range of any living mammal.

Even the tiger, of which, together with the lastmentioned animal, there are now remarkably fine spec-

imens at the zoological parks, is not supposed to have been originally a tropical animal. Its fossil remains are associated with those of the mammoth in the New Siberian Islands. which are situated well toward the pole within the Arctic circle, and living specimens are yet found as far north as Lake Baikal in Siberia.

But the member of the Felidæ apparently best fitted by nature to withstand a cold climate is without doubt Felis onca, the long-tailed or snow leopard. This animal never descends beyond the snow line of the mountains it inhabits. It is associated in the high lands of central Asia with the Siberian ibex, the big-horned argali, and Marco Polo's sheep, animals more or less akin to our Rocky Mountain goat and sheep.

The specimen at the park, a fine male in splendid health and condition, although not yet fully grown, is at least as large as any ordinary leopard, and on account of the long and thick coat of fur with which it is covered, it looks much heavier. Indeed, in this respect it seems to suggest a similar variation from the ordinary type to that exhibited by the longhaired breed of domestic cats when compared with our common fireside pussies.

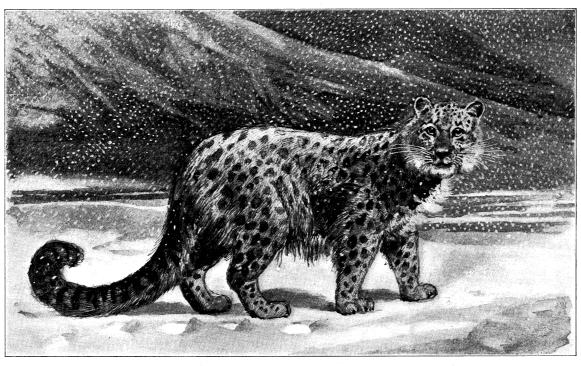
The color of the snowleopard is a gray inclining to buff. A few large, dark spots show about the lower parts, and a number of smaller ones congregate about the head and the neck. The back and the sides are marked with faded-looking brown rings or rosettes. The comparatively enormous tail of the animal is fully as long as his body. "Chang" is the first of his species ever seen in this country. He is the sole survivor of four of the species collected by Mr. Hagenbeck's agents in the northern border of

Thibet, and is one of the only three snow leopards now in captivity, of which Berlin has one and London another

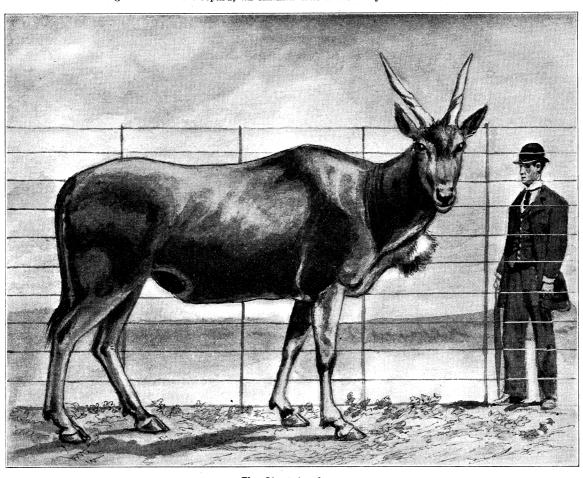
Mr. Hornaday, director of the New York Zoological Park, says that sometimes as many as two thousand tanned skins of the snow leopard are brought from the interior of China to Shanghai in a single year, but that "not one live specimen accompanies them. The distance," he says, "is too great, and the difficulties to be encountered with a live animal in a cage are too numerous to tempt even a Chinaman to try to surmount them. Naturally, these animals are very costly; the price of our specimen was nine hundred dollars."

Another late addition to the attractions of the park is a fine large eland (Oreas canna), the giant species of antelope that equals an ox in size, reaching the

height of nearly or quite six feet at the withers. For all its ponderous proportions, the eland is not an ungraceful-looking creature. The expression is mild, and the head is decidedly of the antelope type. It seems as though such an animal might be domesticated here, as it has been in numerous instances in England. The flesh when the eland is properly fed, is superior to beef in delicacy and flavor; and certainly an animal that without special breeding puts on a weight of from eight hundred to one thousand five hundred pounds and more, is worth experimenting with. One peculiarity of this magnificent animal should recommend it for the great plains of the Southwest, and that is its capacity of going for a long time without water. The ease with which it is reared, its mild disposition, the fact that it breeds freely in captivity, the great value of its hide as well as of its



Long-Tailed Snow Leopard, an Animal that Lives Only Amid Snow and Ice.



The Giant Antelope.

## INTERESTING ANIMALS AT THE NEW YORK ZOOLOGICAL PARK.

flesh, and the rapid improvement it shows under scientific cultivation, all conspire to increase the regret with which we see it rapidly approaching extermination in its native country. Few indeed of the wild members of the order of hoofed mammals exhibit so many claims for domestication and preservation by the human race. Particularly is this the case in a country like our own, which includes regions reproducing in so many particulars the character of the particular parts of the African continent included in the range of these giant antelopes.

The Russian Board of Mercantile Shipping and Harbors is working out a project to connect the White Sea, near Soroka, with Lake Onega, near Powyenetz, by means of a canal, which would be 135 miles in length, and which would cost £1,320,000.

#### THE LESSON OF THE BALTIMORE FIRE.

BY DAY ALLEN WILLEY.

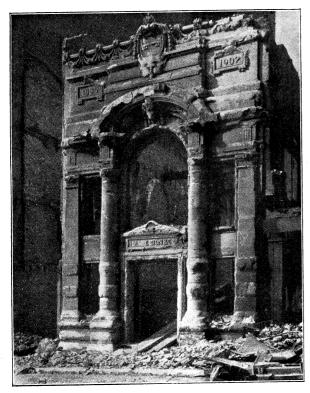
Enough time has elapsed since the conflagration occurred in Baltimore for architects, builders, insurance investigators and other experts to form an intelligent opinion as to the actual destruction caused, and to draw some conclusion as to the effect of heat and flames on various materials. It is admitted that no fire has ever occurred in the history of the world where a greater variety of buildings were damaged or destroyed; for, as is well known, they ranged in character from small antiquated structures of brick and masonry, two and three stories high, to the modern office building. Especially interesting, however, was the effect of the fire upon bank buildings recently constructed. Within the last few years, more of these edifices have probably been built in Baltimore than

elsewhere in the countrybuildings designed exclusively for banking purposes, and erected of what was supposed to be the most durable material and provided with the latest appliances which modern ingenuity has devised for protection against fire. Some of these buildings were literally works of art, but one story in height, their exterior composed of massive walls of granite or marble lined with masonry, the framework being of heavy steel girders, and the roof of metal, save where skylights of thick glass were used. Nearly all the skylights, however, were protected by a metallic grating placed a few inches above them. With the exception of the counters and furniture, carpets, and ornamental hangings, the interiors of these banks were supposed to contain no material which would burn, the majority being finished in ornamental metal or stone work with floors of tile, marble, or concrete. With three exceptions, however, these structures suffered as heavily as the others, the interior being literally wrecked. One of the three -the building of the International Trust Company -was principally damaged inside by the wall of the adjacent building falling through the roof, and not so much by the fire. A building recently built by Alexander Brown & Sons had exterior walls of red brick with marble trimmings, being of colonial architecture. Except for the scorching of the walls it was unhurt, although in a portion of the city where the fire was most destructive. The building of the Safe Deposit and Trust Company, also in the heart of the burned district. escaped with slight damage. It was faced with stone, but the masonry lining of the interior was over two feet in thickness.

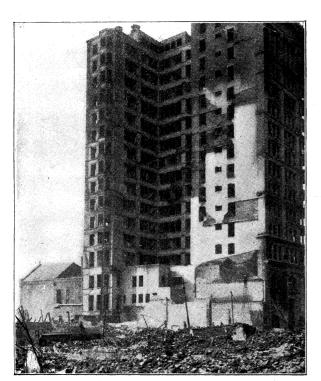
An examination of the

stone ornamental work of the bank and office buildings showed that apparently polished granite withstood the action of the flames and heat much better than the rough surface although not only granite but marble and other stone was subjected to such a temperature that it cracked off pillars and other portions of the walls in chips, some of which weighed four or five pounds. In fact, the sidewalks around most of the larger buildings were piled with pieces of marble, granite, and brownstone, in some places to a depth of two or three feet. It was noticeable that but little of the terra cotta crumbled away, and most of the brick which fell came down in the walls, but few pieces of brick being detached separately.

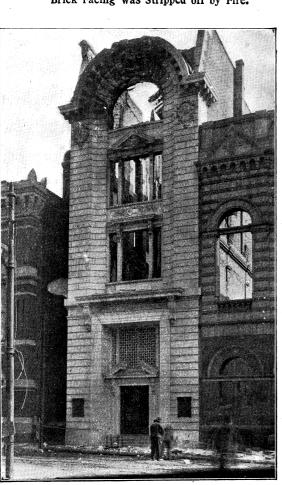
Some peculiar instances of the effect of the heat upon different kinds of stone were noted at the International Trust building, also in the United States bonded ware-



New Banking House, Showing Action of Fire on Sandstone Front.



East Side of Continental Trust Building, Showing How Brick Facing was Stripped off by Fire.



The Farmers' National Bank Building. The Three Upper Floors (Non-Fireproofed) Burned Out. The First Story (Fireproofed) was Unharmed, Not Even the Glass of Front Door Being Broken.



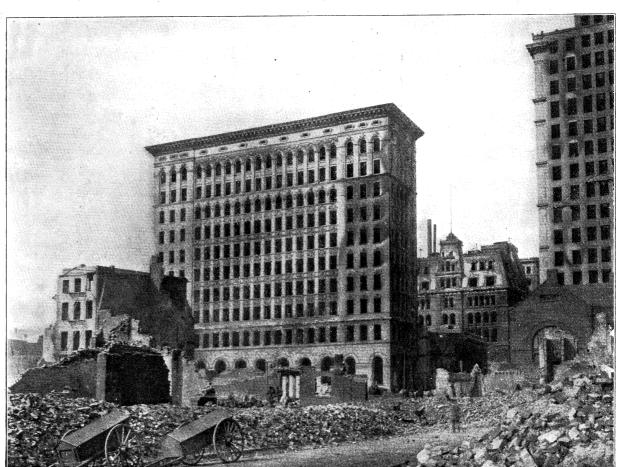
Merchants' National Bank, Showing Sheet-Iron Shutters Burst Open by the Sudden Combustion of Gases Within the Building.



The Fire-Swept Equitable Building With the Unharmed Court House to the Right.



Union Trust Building, Showing the Severe Spalling of the Stone Facing.



Maryland Trust Building Left Standing Among the Ruins of Non-Fireproofed Buildings. The Limestone Facing of Three Lower Stories and Terra Cotta Facing of Upper Stories Showed Good Fire-Resisting Qualities.

LESSONS OF THE BALTIMORE FIRE.

house. A portion of one of the pillars supporting the front wall of the Trust building was reduced to about half its ordinary size, appearing as if it had been shattered with the mallet and chisel of the stone cutter. The government warehouse which was one of the oldest buildings in the burned district, was practically unhurt, with the exception of a stone column near the entrance in the interior. The effect of the heat upon this was to chip off its surface, so that it is now only about half its former size. The outside walls of this building, composed of ordinary brick, were practically unhurt, with no cracks appearing in any of them. Over a thousand barrels of liquor were stored in the interior, but so thick were the walls that the temperature did not rise sufficiently to ignite the contents of the building.

One of the most interesting features of the disaster was the way in which the new Baltimore court house checked its progress, although it stood directly in its pathway and was probably exposed to a greater heat than any other structure. It was separated from the Law building, a seven-story structure, by only forty

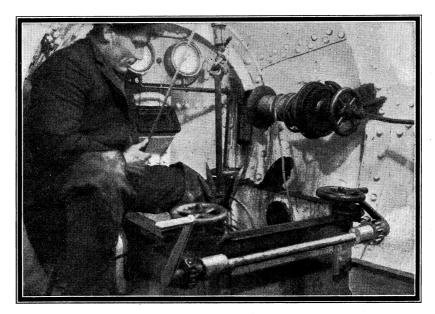
feet of space. When the Law building ignited, the fire was burning over an area of ten city squares southwest of it. Filled with inflammable material, its interior was soon a mass of flames, which were carried by the air current directly against the upper west wall of the court house, and at times extended thirty and forty feet over its roof. In fact, the fire was directly in contact with the wall for fully a half hour. The interior of this part of the court house was flooded with water, while the walls and ceiling were kept wet. On examination it was found that the window casings were charred, and some of the marble coping which surmounted the wall was broken, while the upper part of the wall was chipped and blackened. Not once, however, did the building ignite inside, owing to its massive construction. The exterior is of Maryland marble, which with the inner lining of masonry gives a thickness to the walls ranging from three feet to three feet six inches. The effects noted, as well as others, have led most of the experts who have visited the burned district to

conclude that brick and terra cotta are far better building materials for resisting heat than almost any form of natural stonework; for even the outside walls of the older buildings. as well as division walls, though in many cases completely disintegrated, showed that the brick themselves were but little injured, and the bulk of them can be used for rebuilding if desired. Naturally, the steel framework of the office buildings has been subjected to close study; and although it was feared at first that it was subjected to such intense heat that the strength of the metal would be impaired, and

that it would be dangerous to use it as a support for financial district, shortly before midnight, and the nuge, sinister face. The torpedo tubes appear to be any great weight, such as walls or floors, architects Continental, Baltimore & Ohio, and the Equitable build- the eyes; the bow anchor-weight hole, the nose; and the and erectors of steel-frame buildings in general are of the opinion that it is only necessary to remove the columns and girders which were warped and twisted, and replace them, when the structures will be as substantial as before the fire. Instrumental measurements show that none of the larger buildings are out of the perpendicular line. In all cases, however, it is agreed that the interiors must be entirely renewed. In many instances arched floors have either crumbled away or are so badly broken that they must be rebuilt. Much of the flooring consisted of a form of fireproof concrete laid upon the steel girders, and finished with tiling of marble and terra cotta. In the Union Trust and some other office buildings, most of the flooring fell through to the cellar. In the buildings where it remains, it is so loosely attached that nearly every day since the fire, portions have been falling, sections of three floors giving way unexpectedly in the Equitable building a week after the fire had been extinguished.

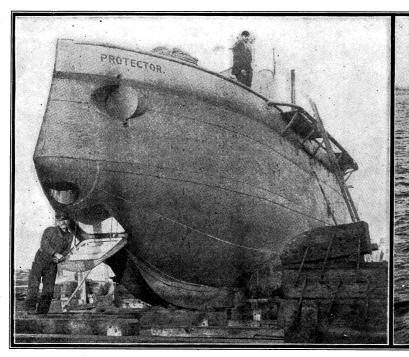
The leaders of the Baltimore fire department, as well as insurance men and others familiar with conflagrations, have advanced some interesting theories as to the remarkable rapidity with which the fire spread over the burned area. When it started, the wind was not blowing a gale, as has been stated. In fact, its maximum velocity was not over thirty miles an hour at any time during the day. It is unnecessary to say, however, that as the number of burning buildings increased, and heat was generated in proportion, a draft was caused in the immediate vicinity of the fire, which possibly represented a gale in the force of the air current.

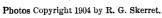
This artificial wind, as it might be termed of course was blown toward the north and east, since it was aided by the ordinary breeze which came from the southwest. An enormous volume of hot air was driven ahead of the fire as the result of the atmospheric disturbance, and it is believed this had much to do with the spread of the conflagration. In fact, the heat was so great, even where the fire was confined to a single block, that persons on the roofs of buildings 500 and 600 feet away were unable to face it, and were obliged to leave them. When the flames had reached the



Copyright 1904 by R. G. Skerret.

The Diving Compartment, Showing Windlass and Grapuel Bringing up a Cable from the Sea Bottom.





The "Protector" in Drydock, Showing Diving-Compartment Door Open.

ings were on fire at the same time, it was impossible for any one to go within a square of this section, on account of the temperature. Consequently, it was absolutely impossible to attempt to throw a stream of water upon the fire from the north or east of these buildings, and many times during the day the firemen could not even reach the edge of the burning territory for the same reason. The opinion has been advanced that in many cases

the volume of superheated air actually set fire to structures 300 and 400 feet beyond the limit of the flames. The writer and other observers noticed several instances where buildings ignited in this way some time before the main fire reached them, flames and smoke issuing from the interiors, and not from the roofs. It might be said here, that as soon as the extent of the conflagration was realized forces of men were sent to the roofs of all the buildings throughout the business district for a half mile or more around the burned area, in order to prevent them from being ignited by the quantities of sparks and cinders. In nearly every

instance the efforts made in this way with buckets of water, brooms and sprinkling hose were successful, and thus far no other cause has been given for the manner in which some of the isolated buildings caught fire, except the action of the hot air penetrating the interiors.

Another proof of this theory is shown in the way buildings protected by "fireproof" shutters were affected. The rear wall of the Merchants' National Bank building was completely protected in this manner, every window being guarded by shutters of sheet metal, which were closed and barred on the day in question. A number of the large warehouses on Hopkins Place were also provided with shutters of the same kind, yet in nearly every instance they were burst open, apparently from some force within, and in a number of cases the opening of the shutters was followed by flames shooting from the windows, although no signs of fire were visible on the other sides of the buildings. An examination of the Merchants' Bank building on the day following the fire showed that every shutter had been forced open as stated.

> It is generally acknowledged that only a change in the direction of the wind saved a much larger portion of the city from being destroyed, as the change turned the wave of fire and hot air southward, where it terminated on the harbor front. In the study of its ravages, the question has arisen if destruction of similar or even greater magnitude would not result in other cities, if the conditions were similar to those in Baltimore.

> It is admitted that "skyscrapers" had little or no effect in checking the progress of the fire, and when it was once ablaze it could not be approached near enough for the firemen to do any effective

> The Baltimore buildings, it is believed, were constructed as solidly and substantially as the average office buildings in New York, Philadelphia, or Chicago. In the latter cities these great structures are more numerous and built more closely together than in Baltimore, and many of the insurance officials especially are of the opinion that a fire in one of the cities named might do even more dam-

> > age, if it passed beyond the control of the fire department.

### OFFICIAL TEST OF THE LAKE SUB-MARINE BOAT "PROTECTOR."

The test of the submarine boat "Protector," made by an Army Board recently. is fully described on another page. The accompanying illustrations show the appearance of the boat after rising under a huge cake of ice 8 inches or more in thickness: the interior of the diving compartment; and the bow of the boat when in dry dock. The last-named is the most striking picture. In it, the boat's prow has the appearance of a

door of the diving compartment, the mouth of the huge sea monster. The interior view of the diving compartment shows the grapnel bringing up a cable through the door in the floor. The windlass at the side is used to haul up the grapnel after it has picked up a cable. The small rectangular glass in the front of the compartment is for looking at the bottom without opening the compartment door. The tube from this glass leads into the anchor weight hole in the bow, and so this window can only be used when the weight is out of its casing. The diving compartment is the great feature of the Lake submarine that distinguishes it from all others. The picture of the ice-covered boat tells its own story and shows that the new submarine is ice as well as waterproof, and could be used for breaking a channel by running under the ice and coming up under it, if it could be done in no other way.

The Ice-Covered "Protector" After a Run.

Army Board members on the deck and conning tower.

The first discovery of coal in the United States recorded in history was in 1679, at a locality near the present city of Ottawa, Ill.

#### QUEER HIDING PLACE FOR BEES.

BY HELEN LUKENS JONES.

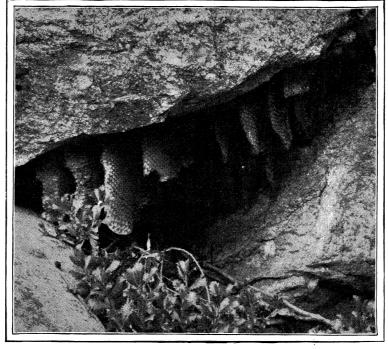
During mountain tramps it is not unusual to find bee nests in the hollow trunks of trees and in other odd places, but they are seldom discovered nesting among the rocks in the picturesque fashion illustrated by the accompanying photograph. This particular swarm was found in the Sierra Madre Mountains back of Pasadena, California, where in the seclusion of a rocky wilderness they were accumulating stores of sweets without fear of human intrusion or human theft. They had a well-stocked establishment with rock walls, rock roof, and rock foundation. It was a home impervious to rain or wind. The busy workers had certainly shown clever foresight in their selection of a home, for it was situated some distance from the beaten trail, and being surrounded by a dense copse of brush, grasses, wild sage, and yucca, was as nearly isolated as it could possibly be. White sage and black sage, the most prolific honey-producing plants in Southern California, grow luxuriantly in this locality. The bees have not far to go to the honey market for

their load of sweets, and in the cañon a few rods below is a brisk mountain stream where they can drink. This bee cave extends back into the cliff about four feet. The entrance is four feet in width and eighteen inches in height. It is completely filled with combs, the bees having hung their honeyed tapestry to the very threshold. This hermit swarm was composed of fine, full-blooded Italians that had undoubtedly escaped from some mountain apiary.

## Are the Canals of Mars Illusions?

In Knowledge, Mr. E. W. Maunder and Mons. E. M. Antoniadi both contribute illustrated articles to show that the Martian Canal system, as figured by Schiaparelli and others, is largely an illusion. Mr. Maunder has made experiments at the Royal Hospital School at Greenwich and thus describes the results: "A class of about twenty boys, from twelve to fourteen years of age, were seated in four or five rows at different distances from a carefully-lighted diagram, which they were told to copy. The diagram was reproduced from some published drawing of Mars, but in nearly every experiment the canals were omitted. The diagram was generally about six inches in diameter, and the dis-

tances of the boys from the diagram ranged from fifteen to forty feet, except in two experiments where the range extended up to sixty feet. . . . The general result was striking. In several of these experiments nearly all the boys drew "canals" on their copies, though there were none on the original from which they were copying. And these "canals" were not placed at random; they were just in the very places where canals are seen in the charts of Schiaparelli and Lowell. | . . . Whence then did the "canals" come which were drawn by the boys of the Hospital School? One cause was the prolongation of dark indentations invading the brighter regions. . . . A more fruitful source of the "canals" was the introduction of regions slightly darker or slightly brighter than their surroundings. Meroe Island figured as an example in the first category, Elysium as one in the second in two different experiments. And no one could wish for straighter and sharper "canals" than were drawn by a good proportion of the boys to express these regions. . . . But the cause which was the most effective within the limits of our experi-



REMARKABLE BEE'S NEST IN THE MOUNTAIN ROCKS.

ments with the Hospital School boys was the way in which the eye summoned up together minute irregular markings, each too small to be separately perceived as straight streaks. . . . The general distribution of the true markings on the planet must approximate to that shown on the charts of Schiaparelli and Lowell, and the details if not straight lines in their ultimate conceivable resolution are at least straight lines to the eye. But the gain is really great. For so long as we conceive of that elaborate reticulation as being a true feature of the actual surface of the planet, we can hardly escape from Mr. Lowell's induction. Line3 so straight, so formal, so uniform in width so regular in their intersections, so symmetrical, with dark spots so inevitably marking their intersections, must be accounted, as he accounts them, artificial; the handiwork of intelligent beings. But if actual details of perfectly irregular and unsymmetrical character details having no sign of artificiality about them, can present exactly the appearance, and make just the impression which the network of the canal system does the argument for the existence of inhabitants on Mars

> has vanished. We are freed, too, from the necessity of considering such bizarre theories as would make out the planet to have been scored into its present form by grazing meteorites, or to have assumed it through crystallization. To have been set free from the grotesque in observation is to have been freed also from the grotesque in speculation. This service I think the drawings of the Hospital School boys have effectually rendered to us. They have shown that perfectly unbiased observers will see and draw the Schiaparellian canals when the actual markings presented to them are as little regular and artificial as any which our own earth might present to an outside spectator."

## Technical Schools in Germany.

Of the total of 3.610 students in the German technical schools for the year 1902 no less than 1,359, or 37.6 per cent, were foreigners. This is a very heavy percentage of foreigners, and surpasses the percentage at the technical universities, which generally ranges from 10 to 30 per cent. At the Mining High School at Freiberg, the number of foreigners is still greater; in 1901 there were 280 foreigners to 186 Germans.

### RECENTLY PATENTED INVENTIONS. Heating Appliances.

MUFFLE .- J. CARTER and A. G. CARTER Malden, Mass. Fires being lighted in the fire holes by means of fuel resting upon the grate bars, the smoke and gases of combustion pass upwardly through all of certain passages to a chamber and downward through a central flue Arriving at the bottom the smoke and gase radiate, then pass upwardly through passages deflect through arches, pass through more pas sages into a stack and escape. Upward drafts are arranged alternately with other upward drafts. Air is drawn inward and divided and distributed to flames at points above the bars The device acts somewhat in a smoke-consumer capacity, causing combution, saving fuel and distributing heat.

ASH-DOOR.-E. C. Cole, Chicago, Ill. The object of this invention is the provision of a novel construction of connection between the stove-section and the cover-section of such door, whereby the cover-section can be conveniently applied to and removed from the stove-section and will be properly hinged in connection there with when applied, and to so construct the parts that the fitting or bearing surfaces between the two sections can be conveniently ground on emery or other grinding wheels to a true surface.

## Machines and Mechanical Devices.

present instance the invention has reference to means for arresting the cage or hoist of an elevator in case of accident, and the object that Mr. Hallock has in view is the provision of simple devices adapted to be easily and cheaply supplied to existing or newly-installed elevators, and capable of service in a way to check and arrest a swiftly falling loaded car without injury to the apparatus and its load.

MOLDING-MACHINE .- J. J. TURNER and J. A. Dowler, Laharpe, Kan. This improvement has reference to machines for forming vessels of plastic material, such as condensers made of clay and used in retorts employed in zinc smelters. The object is to provide a molding-machine which is simple in construction, easily manipulated, and arranged to allow of forming the vessels of uniform size and shape without requiring the employment of skilled labor.

GLASS BLOWING AND FINISHING MA-CHINE .- J. Schies, Anderson, Ind. In this patent the invention is a combined blowing and

it is delivered from the press-molds of an ordinary glass-machine to finish the mouth thereof and to produce an internal groove within the neck of the bottle at one operation.

TAPPET FOR STAMP-MILLS.—E. I. Morey, Telluride, Col. In this case the invention's object is to provide a tappet so constructed as to be readily adjusted lengthwise of the stem and also to be adjusted to the possible reduction of circumference due to the wear of the stem in moving in its guides, and, further, to so construct a tappet that it will be practically impossible to displace it when locked in place.

LUBRICATOR FOR YARNS OR THREADS. -C. J. LEHMAN, dec'd, New York, N. Y.; PAULINE LEHMAN, administratrix. It is necessary to apply a lubricant to yarn or thread while it remains in winding machinery—as, for example, when it passes from a reel to a spool and to accomplish this end the inventor has devised a device employing a lubricant in a solid form as distinguished from a bath of liquid lubricant, thereby securing economy in the quantity used in treatment of the threads, these being of any weight and color and of any material such as wool or cotton.

STITCH-FORMING MECHANISM.—E. C. HENDERSON, Pictou, Nova Scotia, Canada. To the end that a lock-stitch may be formed without the use of a shuttle and its appurtenant parts, this mechanism comprises a needle carrving the needle-thread as usual, a guide MEANS FOR ARRESTING ELEVATOR adapted to carry a second thread to complete CARS.—P. F. HALLOCK, Detroit, Mich. In the or other means for drawing the thread from the guide, these elements being constructed and arranged in a certain novel manner.

OFF-BEARING MECHANISM FOR SAW-MILLS .- E. T. Davies, Portland, Ore. Of several objects in view in this invention Mr. Davies has particularly one in the provision of a mechanism which will engage with the stick or plank as fast as it is sawed by the sawing mechanism of the mill and will remove the plank from the main block of timber or the cant and deposit the same on the carrying or conveying device of the machine or saw-mill. It is capable of being applied to any of the well-known forms of sawing-mills now in use.

## Of Interest to Farmers.

CULTIVATOR .- W. J. LUTTRELL, Honeygrove, Texas. In this invention the improvement is in that class of wheel-cultivators in shovels are attached to a saddle or cross-head

justed at different angles to the surface or to the line of draft. There are means for attaching the foot-piece to the cross-head, whereby it may be adjusted and clamped at any angle with great facility.

BUTTER-PRESS .- F. MURPHY, Lisbon Center, N. Y. One of the principal objects of this invention is the provision of devices or means by which a plurality of prints of butter or like substance may be molded at one and the same time, each possessing the desired shape, dimensions, and weight, as well as having thereon an impress of any suitable design.

BROODER.-S. FUSTON, Murfreesboro, Tenn. In this apparatus the object is to supply heated fresh air plentifully with a minimum expenditure of oil. The brooding casing is constructed in two compartments, one lower than the other, and with a door hinged at its lower end, so it can be turned down to form an inclined runway from the upper to the lower compartment or can be turned up to form a separat ing-wall between the two compartments. The great advantage secured is the thorough warm ing of the body of the chick while giving it comparatively cool fresh air to breathe.

## Railways and Their Accessories.

DEVICE FOR RELEASING TRUCKS FROM CARS.—R. L. RILEY, Newburgh, N. Y. Trucks ordinarily are connected to a car-body through the medium of a large bolt or pin, termed a and in order and disconnect or remove the truck from beneath a car-body it is necessary to enter the car and pull the pin from its socket, and this is inconvenient when the car is heavily loaded, as the cargo adjacent to the pin-socket must be shifted to have access to the king-pin. With this invention the pin may be easily removed without entering the car and without disturbing the contents. Should the cargo consist of a granular substance small particles will not drop through the casing and interfere with the operation of the pin-releasing device.

## Miscellaneous.

ICE-MAKING APPARATUS.—H. STOUT, Kingman, Kan. The principal object in this invention is to provide a water-freezing apparatus or plant for the manufacture of ice which is comparatively inexpensive to construct, which is reliable in operation, easy of access and control, and not liable to get out finishing machine designed to take the bottle as on the draft-beam in such manner as to per-linclude a single water-compartment only or a whiripool.

a series of such compartments, and any suitable material may be employed. It may be rectangular in shape and of any desired height and other dimensions.

HORSESHOE-PAD.—J. F. ROBINSON, Rockway, N. J. The purpose of this improvement is to provide a pad which is almost entirely constructed of comparatively soft rubber or like clinging and yielding material and to provide suitably placed and concealed metal stays, either removable from the body of the pad or immovably placed therein by reason of the body of the pad being molded or cast around the stays.

LEMON-SQUEEZER .-- A. McLAREN, Fort Worth, Texas. The squeezer cuts and squeezes a lemon with one operation. The invention consists, in peculiar means adapted to strain the juice, and, further, of peculiar devices automatically operating upon upward movemen, of the squeezing-lever to discharge the squeezed portions of the lemon.

MEANS FOR HOLDING PIANO TUNING-PINS .- G. Ruckstuhl, Rutherford, N. J. Owing to successive tuning of a piano and continued strain of the strings the pins work loose and enlarge the holes in the pin-block. Mr. Ruckstuhl's object is the provision of means for protecting the pin-block and for securely holding the tuning-pins in their adjusted positions, said means dispensing with the usual dowels and holding the pins and strings in a way to avoid the production of metallic tones when the keys are struck.

POMADE-CAN.-E. L. PITTS. Jerome, Arizona Ter. Mr. Pitts' improvement is designed especially for use by barbers for holding pomade, vaseline, or the like, and has for an object the provision of a simple, novel construction whereby the user may be able to procure the desired amount of the pomade or vaseline from time to time. The device will hold various kinds of jellies, salves, etc., and will permit convenient removal thereof in any quantities, and is able to exclude all dust and dirt in a simple manner.

AMUSEMENT DEVICE .-- A. G. HAMMELL, New York, N. Y. The purpose in this invention is to provide a structure upon which cars or vehicles are drawn up an inclined plane by a cable or the like and relieved from the cable when the upper portion of the incline is reached and to construct a spiralway or track leading from the upper point of the plane, where the vehicle is released, the contracted portion of the spiral being its lower portion, whereby as which the shanks or foot-pieces carrying the of order. The apparatus or plant may be cond the vehicle descends the way the occupants structed on a small or a large scale, and may will experience sensations as when drawn into

COMBE, Wattsburg, Pa. The object of this invention is to furnish thread-spools or bobbins with an improved attachment for receiv ing and supporting sewing and other needles while not in use. The improvement may be applied to spools or bobbins adapted for holding yarn as well as sewing thread and the cushion may in some cases be inserted in a bore or socket formed in the spool outside of or eccentrically to the bore and made in any form, cylindrical or square, etc.

BOILER-BRACE .- J. A. PEMENT, Chicago, The invention relates to steam-boilers: and the inventor's object is to provide a new and improved brace, more especially designed for use between the shell and the head of a beiler and arranged to prevent the brace from arching or buckling upon subjecting the boiler to heavy pressure. No matter in what direction the strain comes on the brace, the brace properly fulfills at all times its functions, with the great advantage of rendering the boiler very strong and safe.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

## Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. In every case it is necessary to give the number of the inquiry. MUNN & CO.

Marine Iron Works. Chicago. Catalogue free

Inquiry No. 5226.—For manufacturers of a machine for converting straw into fuel.

AUTOS.-Duryea Power Co., Reading, Pa.

Inquiry No. 5227.—For manufacturers of tubular chime clocks.

"U.S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 5228.—For a plant for producing carbonated goods on a small scale. Sawmill machinery and outfits manufactured by the

Lane Mfg. Co., Box 13, Montpelier, Vt. Inquiry No. 5229.—For machinery for extracting fiber from the cocoanut husk, also for manufacturing cocoanut oil.

Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway

New York. Free on application Inquiry No. 5230.—For machinery for extracting the oil from plants, for use in perfumery manufacture.

The largest manufacturer in the world of merry-gorounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 5231.—Wanted, address of the present manufacturers of the Shipman engine.

We manufacture anything in metal. Patented articles. metal stamping, dies, screw mach. work, etc., Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 5232.—For a small upright steam or kerosene boiler of 3 or 4 h. p. for laboratory use.

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.

Inquiry No. 5233.—For makers of lead, iron, galvanized and Swedisn iron, iron pipes, faucets, etc.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 5234.—For manufacturers of rubber goods, such as boots, waterproofs, tubes, water bags, etc.

Inquiry No. 5235.—For machinery for a large varnish factory with capacity of 1,000 to 2,000 gallons per day.

Inquiry No. 5236.--For manufacturers of wire goods, such as baskets, bric-a-brac, frames for kitchen lamps, etc.

Inquiry No. 5237.—For makers of curtains operated by spring, for street electric cars.

Inquiry No. 5238.-For makers of knitting machines.

Inquiry No. 5239.—For makers of quarry equipments, such as channelers, gangsaws, etc.

Inquiry No. 5240.—For makers of adjustable folding lawn or porch chairs and settees.

Inquiry No. 5241.-For manufacturers of drawn steel cylinders.

Inquiry No. 5242.—For firms to manufacture an electric or gasoline automobile hose or truck wagon to carry 1.000 feet of fire hose, for a volunteer fire department.

Inquiry No. 5243.—For makers of glass paper weights and novelties.

Inquiry No. 5244.—For makers of papier maché novelties. Inquiry No. 5245.-For manufacturers of tool

Inquiry No. 5246.—For makers of calculating machines.

Inquiry No. 5247.-For makers of woven and printed labels and straps for shoes.

Inquiry No. 5248.—For makers of small steam engine cylinders of the slide valve type of about 136 inches stroke and 34-inch bore, either metal or brass.

Inquiry No. 5249.—For a machine for printing on lead pencils.

Inquiry No. 5250.—For a Taylor calculating machine,

Inquiry No. 5251 .- For makers of level glasses.

Inquiry No. 5252.—For makers of lathes, planers, drill presses gasoline engine, castings and automobile Inquiry No. 5253.—For a machine for imparting power to churn dashers, washing machines, also makers of corn-husking machines operated by hand.

Inquiry No. 5254.—For makers of dish-washing machines.

Inquiry No. 5255.—For makers of typewriters ranging in prices from \$35 to \$60.

Inquiry No. 5256.—For makers of handles for rakes, forks, etc.

Inquiry No. 5257.—For a covered automobile carrying 12 to 14 persons.

Inquiry No. 5258.-For broom-making machin-

Inquiry No. 5259.—For a small model ¼ h. p. steam engine boiler for demonstrating purposes. Inquiry No. 5260.-For makers of papier maché

#### DUN- INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

March 1, 19 <b>04.</b>	
AND EACH BEARING THAT I	DATE
[See note at end of list about copies of these p	oatents.]
Abrading device, P. EkvallAcids and bromated phtalic acids with naphtols, making condensation products from dicarbo, Denguine & Levinsohn.	753,251
tors, making condensation products from dicarbo, Denguine & Levinsonn Adding and subtracting apparatus, automatic Not Kodama	753,372 753 586
from dicarbo, Denguine & Levinsohn. Adding and subtracting apparatus, automatic, N. H. Kodama Adjustable wrench, A. Heberer. Advertising cabinet, M. Kovacevic. Air brake controller, J. C. Wands. 753,648 to Air compressor, C. S. Dean. Air compressor governor, H. Saam. Amusement apparatus, L. A. Thompson. Anchor, W. Hector. Anglers' artificial flies, apparatus for storing or carrying, G. A. Pickard. Anthracene derivative and making same, R. Bohn.	753,586 753,489 753,587 753,650
Air compressor, C. S. Dean	753,650 753,787 753,633 753,449
Anchor, W. Hector	753,449 753,394 753,309
Anthracene derivative and making same, R. Bohn	753,659 753,422
Axle, W. P. Wheox.  Baling press, W. F. Jacobs.  Ball. See Billiard or pool ball.	753,816 753,402
Bank, savings, I. D. Perry	753,525 753,505 753,500
Bean picking machine, G. F. Crippen Bearing, antifriction, W. W. O'Connor Bearing, antifriction, W. C. Baker	753,370 753,619 753,820
Bed construction, couch, F. M. Tinkham Bed, spring, I. H. Haas Bedstead brace clamp, F. H. Childs	753,820 753,760 753,698 753,362
Beer cooler coils, device for protecting, J. Thuemling Beets, machine for blocking sugar, J. H.	753,450
ing or carrying, G. A. Fickard. Anthracene derivative and making same, R. Bohn. Armature winding, J. F. McEiroy. Axle, W. P. Wilcox. Balling press, W. F. Jacobs. Ballin See Billiard or pool ball. Ball and socket fastener, J. R. Smith. Bank, savings, I. D. Perry. Baskets or cases, apparatus for cleaning bottle, R. Knollner. Bean picking machine, G. F. Crippen. Bearing, antifriction, W. W. O'Connor. Bearing, antifriction, W. C. Baker. Bed construction, couch, F. M. Tinkham Bed, spring, I. H. Haas. Bedstead brace clamp, F. H. Childs. Beer cooler coils, device for protecting, J. Thuemling Beets, machine for blocking sugar, J. H. Uhl Bell, N. W. Crandall, Bells, making, J. T. Duff. Bending device, T. Damm Bending machine, J. F. Martin. Bevel, W. V. Morrow. Billiard or pool ball. Haskell & Brigham.	753,451 753,369 753,248
Bending machine, J. F. Martin	753,553 753,801 753,419 753,392
Bells, making, J. T. Duff. Bending device, T. Damm Bending device, T. Damm Bending machine, J. F. Martin. Bevel, W. V. Morrow Billiard or pool ball, Haskell & Brigham. Binder, loose leaf, A. Opalla. Blackboard machine, W. T. Jordan. Boat, metal, S. D. Noel. Boiler drying attachment, W. B. Swartwout Bolt threading head, W. Rievaldt. Book carriage, Goodman & Wurtele. Book handle, G. Koch. Book rounding, backing, and lining machine, C. W. Lovell. Boot or shoe, J. Keats. Borer, post hole, M. P. Curlee. Bottle, A. Friedmann. Bottle closure, A. Gaul, Jr. Bottle filling machine, P. J. Cawley. Bottle, non-refillable, Peterson & Hutchins. Box. B. vom Eigen. Box covering machine, H. B. Smith. Brake lever attachment, R. W. Cooke. Brush holder, C. O. Bulock. Brush holder, C. O. Bulock Brush holder, R. Scheuer. Buckle, suspender, L. Neuberger. Buggy boot holder. S. Pearson.	753,805 753,829 753,425
Boiler drying attachment, W. B. Swartwout Bolt threading head, W. Rievaldt Book carriage, Goodman & Wurtele	753,446 753,739 753,484
Book handle, G. Koch	753,585 753,413
Boot or shoe, J. Keats	753,495 753,239 753,564
Bottle closure, A. Gaul, Jr	753,254 753,236 753,306
Box covering machine, H. B. Smith Brake lever attachment, R. W. Cooke	753,524 753,549 753,356
Brush making apparatus, hair, W. W. Carpenter  Buckle, R. Scheuer.	753,234 753,320
Buckle, suspender, L. Neuberger Buggy boot holder, S. Pearson Building block, J. D. Morrison	753,286
Building block, A. F. Hoffman Building blocks or stones, machine for molding, W. L. Dow	753,491 753,377
penter Buckle, R. Scheuer Buckle, S. Scheuer Bugy boot holder, S. Pearson Building block, J. D. Morrison Building block, A. F. Hoffman Building blocks or stones, machine for molding, W. L. Dow. Bung for barrels, etc., valved, J. E. Phillips Burglar alarm, C. H. De Voll Burnishing wheel, G. W. Kimball Button and button fastening, combined, G. W. McGill	753,308 753,244 753,497
W. McGill Calendering machine, C. E. Torrance Camera, G. C. Beidler Camera bed, H. W. Locke. Cameras, multiple view back for, A. E. Lipp Can breasts, attaching hoops to milk, A. T. Kates.	753,612 753,761 753,351 753,800
Cameras, multiple view back for, A. E. Lipp Can breasts, attaching hoops to milk, A. T. Kates	753,279 753,580
Can breasts, attaching hoops to mink, A. T. Kates	753,571 753,353
Canteen, T. J. Pratt	753,558 753,516 753,289
A. Dupuy.  Canteen, T. J. Pratt. Car bolster, A. C. McCord. Car bumper and coupling, mine, J. M. Phillips  Car door, G. W. Kellogg	753,623 753,496 753,811
Car door, G. W. Kenogg. Car door, grain, J. G. Sanborn Car draft rigging, E. C. Washburn Car. dump. O. W. Meissner	753,454 753,506
Car handling apparatus, L. L. Logan Car, hopper bottom, J. M. Ames et al Car safety guard, electrical, C. A. Willard	753,719 753,653 753,341
Car seat, E. Chamberlin	753,545   753,643   753,257
Car underframing, railway, G. I. King Cars of all kinds, safety apparatus for motor, K. Schmidt	753,583 753,436
Cart, self-loading, J. F. Clark	753,716 753,669
Cash register, W. H. Muzzy753,512, Cash registering and checking apparatus, J. M. Carson	753,513 753,235
Cattle guard, Bailie & Anderson	753,220 753,303
Car boister, A. C. McCord. Car bumper and coupling, mine, J. M. Phillips Car door, G. W. Kellogg. Car door, G. W. Kellogg. Car door, G. W. Kellogg. Car door, grain, J. G. Sanborn Car, dump, O. W. Meissner. Car, dump, O. W. Meissner. Car handling apparatus, L. L. Logan. Car, hopper bottom, J. M. Ames et al. Car safety guard, electrical, C. A. Willard. Car sate, E. Chamberlin. Car stake, A. H. Speir. Car, triple hopper coke, J. M. Hansen. Car underframing, railway, G. I. King. Cars of all kinds, safety apparatus for motor, K. Schmidt. Carbon resistance and producing and adjusting same, G. I. Leonard. Cart, self-loading, J. F. Clark. Case. See Packing case. Cash register W. H. Muzzy753,512, Cash registering and checking apparatus, J. M. Carson. Cattle guard, Baille & Anderson. Cements, maturing Portland or other hydraulic, H. A. Gerdes. Chart, skirt, L. Davis. Check controlled apparatus, Caldwell & Martin	753,385 753,680
Martin Check, voucher, W. J. Fabian Chloroform, making, A. W. Smith	753,823 753,480 753,325
Chucking machinery, C. Prouty	753,275 753,430 753,833
Cigar cutter and lighter, Coombs & O'Con- nell Cigar displaying and vending device. G	753,672
Chart, skirt, L. Davis. Check controlled apparatus, Caldwell & Martin Check, voucher, W. J. Fabian. Chloroform, making, A. W. Smith. Chuck disk, J. L. Johnson. Chuckdisk, J. L. Johnson. Chucking machinery, C. Prouty. Chute, portable and adjustable stock, A. B. Copley Cigar cutter and lighter, Coombs & O'Connell Cigar displaying and vending device, G. H. Hagar. Circuit breaker, automatic magnetic, F. O. Hartman Clevis, B. W. Cook.	753,827 753,704
Clevis, B. W. Cook	753,366   753,615
Clevis, B. W. Cook. Clock dials, marking watchmen's A. A. Newman Clock, electric alarm, L. H. Cushman Clock, self-winding electric, Talcott & Kerr Clothes line hanger, R. Alpin Coal separator and washer, H. M. Spencer Cock, automatic stop and waste, J. T. Hutton	753,240 753,757 753,218 753,440
Collar and necktie retainer, O. F. Amburn	753,271 753,784
Comb cleaner, F. P. Bjorncrantz	
Comb cleaner, F. P. Bjornerantz.  Composing machine justifying device, J. A. Watson  Composition of matter, W. A. Price.  Composition of matter, W. Lenderoth.  Concrete bricks, etc., apparatus for the manufacture of, L. J. Dumm.  Condenser, Douglas & Conroy.  Condenser, locomotive tank, Burger & Williams  Condenser, steam, R. W. Knapp.	753,310 753,407
manufacture of, L. J. Dumm	753,249 753,555
iams Condenser, steam, R. W. Knapp	753,357 753,404

Condenser, locomotive tank, Burger & Williams	753,357
Condenser, steam, R. W. Knapp.	753,404
Condensing apparatus, steam, H. A. Duc, Jr.	753,247
Conveyer, M. Foshee	753,247
Conveyer or chute for infilling material, T. Nicholson	753,462
Cooling rack for bars, G. G. McMurtty	753,293
Cooling tower, C. F. Hettinger	753,573
Coop, chicken, H. R. Bridgers	753,228



Foot and Power and Turret Lathes, Pian-ers, Shapers, and Drill Presses. SHEPARD LATHE CO., 133 W. 2d St., Cincinnati, O.

The First Step in Good Belt Making



SCHIEREN BELTING It sounds easy, but you'll understand the labor, skill and judgment required if you read our Dixie Belt Leather Book, which is sent free.

Chas A.Schieren & Co. New York: 52 Ferry St. Chicago: 92 Franklin St. Boston: 192 Lincoln St. Pittsburg: 243 Third Av. Philadelphia: 228 N. 36 St. Denver: 1519 Sixteenth St. Hamburg: Pickhuben 4.

## WORK SHOPS

of Wood and Metal Workers, without steam power, equipped with BARNES' FOOT POWER MACHINERY

allow lower bids on jobs, and give greater profit on the work. Machines sent on trial if desired. Catalog Free.

W. F. & JOHN BARNES CO.
Established 1872.

1999 RUBY ST., ROCKFORD, ILL

## THE NICKEL PLATE ROAD AGAIN SELL-ING LOW RATE COLONIST TICKETS TO THE PACIFIC COAST.

Tickers on sale every day, March 1 to April 30, at rate of \$42.50. These tickets are good in our trans-continental tourist sleepers and via any route desired beyond Chicago. For full particulars see local agents, or write R. E. Payne, General Agent. 291 Main Street, Buffalo, N. Y., or A. W. Ecclestone, D. P. A., 385 Broadway, New York.



Warren's Natural Asphalt Sand Surfaced

## ROOFING

APPLY IT YOURSELF

MAKES A FINISHED GRAVEL ROOF. Comes ready to lay in rolls of 108 square feet Write for sample, circular and prices. Warren Chemical & Mfg. Co., 18 Battery Pl., New York

THE EUREKA CLIP

The most useful article ever invented for the purpose. Indispensable to Lawyers. Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for 25c. To be had of all booksellers, stationers and notion dealers, or by mail on receipt of price. Sample card, by mail, free. Manufactured by Consolidated Safety Pin Co., Box 121, Bloomfield, N. J.







## ARTESIAN

Wells, Oil and Gas Weils drilled by contract to any depth from 50 to 3000 feet,. We also manufacture and furnish everything required to d.ill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 1200 feet. Write us stating exactly what is required and send for illustrated catalogue. Address Pierce Well Engineering And Supply Co. 136 Liberty Street. New York, U.S. A.

#### OSCILLUMS Guaranteed to make any spark plug spark. Send 50

O. K. MACHINE WORKS, 75 Ellicott St., Buffalo, N. Y



Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents. Patents taken through MUNN & Co. receive Special Notice, without charge, in the

## Scientific American

A handsomely illustrated weekly. Largest cir-culation of any scientific journal. Terms, \$3 a year; four months, \$1. Sold by all newsdealers.

Branch Office 625 F St. Washington, D. C.

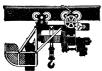
	March	12,	1904.
Copper pouring spoon, Copy holder, B. Hill Corn husking implemen Corn husking machine Cot or lounge, reclinin Cotton gin and conden Cows, antikicker for, Crate, banana, M. Lo Curtain pole, D. Brehn Cuspidor, Burns & Cas	B. H. Benn at, H. Schus feeder, A. Y g, White & ser, E. W. J. Casey mbardo a. steel	ter Vates Miller. Hays	. 753,465 . 753,490 . 753,639 . 753,346 . 753,815 . 753,488 . 753,359 . 753,410 . 753,821 . 753,229
Cutter head, F. Stutz. Cutting irregular form machine for, A. M Davenport and couch, G. G. Hartshorn. Decorticating machine, Dental bridge, F. Teag Dental impression cup	wan	A. L. &	. 753,459 . 753,528 r . 753,444 & . 753,487 . 753,652 . 753,529
Cotton gin and condencows, antikicker for, Crate, banana, M. Lo Curtain pole, D. Brehn Cuspidor, Burns & Cas Cutter bar alinement, Cutter head, F. Stutz Cutting irregular form machine for, A. M. Davenport and couch, G. C. Hartshorn. Decorticating machine, Dental bridge, F. Teag Dental impression cup Davis.  Derrick, C. R. B. Claff Disinfecting attachme Bravi-Berthin  Disintegrating machine Distilling apparatus, w. Dividers, proportional, Door frame, screen, J. Door lock, J. Sliga  Door lock, J. Sliga Door fremovable, J. R. Draft equalizer, J. H. Drawing board, T. L. Dray seat and truck, cart.	in ent, telephology, W. A. Pagood, W. C. I. A. Basola Schnettier Hussey Emert Austin	one, Carryoouglas.	. 753,679 . 753,237 . 753,466 . 753,304 . 753,376 . 753,637 . 753,637 . 753,642 . 753,578 . 753,382 . 753,463
Dray seat and truck, c art	ombined, J.  kiln, C. E. 1  ing mechani  feed appara	D. Stew Pickett. ism, W itus, W	. 753,442 . 753,624 . 753,503 . 753,452 . 753,379 y 753,657
art Drier. See Fruit drier Drying and calculating Drill, J. M. Martin. Drill pressure regulat A. Van Brunt. Drilling machine shot S. Easton Dye and making same, Eayes trough cleaner, Eage or fruit tray, Wil Electric conductors, and knob for, E. ( Electric meter, T. Du Electric switch, G. W Electric wiring cleat, Son Son	G. W. Boyer son & Baker combination U. Hunt can . Hart E. C. Hunt d coil, J. C	bracke Ander	. 753,660 . 753,343 t . 753,399 . 753,550 . 753,258 . 753,398
Electrical conductor and son Electrical connection. Electrical connection, I Electrical machines, Lindeman Electrode, G. J. Atkim Electrodes for storage paring, O. Frank. Electrodynamic general Electromagnetic signal, Electrotherapeutic device electrotherapeutic electr	E. G. Thomas winding for seathery cector, G. M. I.	lls, pre	. 753,714 . 753,759 . 753,278 . 753,819 - 753,383 . 753,429 . 753,365 . 753,509
Elevator retarding de P. Hall Embossing machine s Bresemann	vice, autom	atic, C .753,569 oller, A	. 753,572 . 753,570 . 753,662
Engine driving meen C. Cloyd C. Cloyd Engine igniting device kowski Engine sparking device Engines, electric spart plosive, W. J. Ha Engines, means for att or inlet valves to combustion, L. B. Envelop, L. C. Vander Envelop machine, S.	, explosive, , gas, G. J. king igniter rttaching sucti explosive or Smyserlip	B. Bot Murdock for ex on tubes interna	753,226 753,511 753,795 8 1 753,814 753,333 753,256
Engines, electric spart plosive, W. J. Ha Engines, means for att or inlet valves to combustion, L. B. Envelop, L. C. Vander Envelop machine, S. Evaporating apparatus, kowicz.  Excavating and loading honey Excavating machine, I Eyeglass mounting, E. Fan, S. D. Earl. Faucet, lock, B. R. Be Faucet spout, sheet me Feed trough, knockdow Fence, P. M. Bounds. Fence post, A. Adam.	multiple, machine, D. cock, C. T. Clark deon. etal, W. S. S. n, E. J. Ing	W. Wit H. Ma Drake. Stapley. wersen.	753,777 - 753,282 - 753,477 - 753,364 - 753,687 - 753,349 - 753,749 - 753,2400 - 753,227 - 753,347
Feed trough, knockdow Fence, P. M. Bounds. Fence post, A. Adam. Fence post, W. R. Boi Fiber cleaning machine Filter, Voindrot & Boi Filter and purifier, wa Filtering apparatus, C. Fire escape, J. E. Sm Firearm, breakdown, F Furnaterials, machi F Furnace, See Metallur Furnace, D. A. Ebinge	rdner , M. Prieto illot ter, W. Woo E. Geiger ith R. S. J. Ha . A. Hollenb , P. Frazier	.753,628 ds	753,347 753,467 753,453 753,736 753,780 753,780 753,696 753,700 753,492 753,384
mann Fish cleaning machine, Floor boards, making, Flower pot support, W Fluid materials, machi with, G. A. McAll Folding table, A. W. Food composition, E. Fruit drier, A. A. Q	Manula & E. J. Fulght  C. D. Gridley ne for filling ister Brightwell Dreiss uarnberg	Carlson im.	. 753,707 . 753,722 . 753,791 . 753,485 8 . 753,606 . 753,663 . 753,685 . 753,737 . 753,246
Fuel, H. R. Dorr Furnace. See Metallur Furnace, D. A. Ebinge Furnace, F. Gorman Furnace air feeding de Furnace grate, F. H. I Furnaces, apparatus fe and air to, A. E. Furniture, cushioned F. L. Uhl	gical furnace er vice, G. W. E. C. Nehse. or feeding f Creigh foot for m	Brown.ine fue	753,246 753,250 753,793 753,664 753,298 1 753,673 753,762
Galvanizing plants, co Gibson Game apparatus, C. P. Garment, J. A. Scrive Garment adjuster or ho fenden	Edmunds  Edmunds  In  Idder, J. Wils  Terry  ine, F. Lind W. Curtiss.  dock	son Haf	753,255 753,561 753,322 753,775 753,775 753,596 753,474 753,510
Gas engine, J. M. Stac Gas generating appar J. Atkins Gas generator, acetylen Gas generator, acetylen Flugstad Gas lighting mechanism enhaus et al	delatus, acetyl ne, C. & J. e, E. M. Ro ne, J. M. & , time, F. W	ene, G Tatters senbluth P. M	753,527 753,818 8 753,447 1 753,632 753,691 753,330
Fooling table, A. M. Fool composition, E. Fruit drier, A. A. Gruel, H. R. Dorr Furlace. See Metallur Furnace, D. A. Ebling Furnace, F. Gorman. Furnace air feeding der Furnace air feeding der Furnace, F. Gorman. Furnace air feeding der Furnace, F. Gorman. Furnace air feeding der Furnace, cushioned F. L. Uhl. Galvanizing plants, co. Game apparatus, C. P. Garment, J. A. Scrive Garment protector, D. Garment protector, D. Garment protector, D. Gas engine, G. J. Mur Gas engine, J. M. Stat Gas generator, acetylen Gas making, P. Naef Gas making, P. Naef Gas making, P. Naef Gas producer, J. M. W. Gas, produceing, P. Naef Gas producer, J. M. W. Gas, produceing, P. Naef Geometrical figures, ins struction of equival Glass stone, manufactured	P. Naef G. W. Fulkers, coin free & Bagnall ight and H. f trument for ent, J. C. Wre of, L. A.	ersond mech- Hyatt the con- illmon Garchey	753,295 753,296 753,483 753,658 753,340 753,294 753,458
Glove, G. E. Woodma Gold from rebellious C. Broadwell Golf club, J. G. Curti Golf player's scoring de brod Grain binders, mechanic ed to, W. C. Dury	nores, extractissevice, W. H.	weiss-	753,779 753,822 753,677 753,457 753,559 753,263
Grinding or crushing ap Guide roller, W. H. St Gun sight, Meigs & J.	paratus, T. tobie akobsson	Breakell	753,537 753,753 753,505 753,416

Guide roller, W. H. Stobie. 753,753
Gun sight, Meigs & Jakobsson. 753,555
Gun sight, Meigs & Jakobsson. 753,555
Hair crimper, J. F. Martin. 733,410
Hammer, pneumatic, C. H. Shaw. 753,418
Hammer, power, J. H. Norquist. 753,618
Hanger and track therefor, H. L. Ferris. 75,481
Harmonica holder, O. T. Knode. 753,713
Harvesting machine, E. J. Wang. 753,768
Hat fastener, H. V. Rickard. 753,314
Hat napping machine, M. H. Nein. 753,804
Hay loader, A. W. Bailey. 753,219
Heating buildings or dwellings, system of,
L. M. Gates. 753,253
Heating system, steam, J. R. Shanklin. 753,324
Heddle bar or support clamping device, J.
C. Edwards
Heel for boots or shocs, detachable, F.
F. Anderson. 753,253 C. Edwards
Heel for boots or shoes, detachable, F.
F. Anderson
Hinge, card table, H. F. Keil.
Hinge, self-locking, N. J. St. Hilaire.
Hoe and plant fender, adjustable, II. Lemm
Horseshoe, O. Schramm...... MUNN & CO.361 Broadway, NewYork

753,532 753,710 753,443



MATCH MACHINERY,
BIG MONEY IN MATCHES.
We manufacture everything pertaining to the business. The Very Latest Process. We will furnish a manager or teach any purchaser the business.



Rapid and Positive Handling of Materials in Shops. Fac-tories, Stores, Warehouses fully met by our

Traveling Electric HOISTS Full Details in Bulletin No. 13M

PAWLING @ HARNISCHFEGER 162 Clinton St., Milwaukee, Wis.

# To-day

for our free booklet, ' Economy in the Boiler Room.' It tells how to save hundreds of dollars every year and



lso describes the wonderful Dean Boiler Tube Cleaner-the great scale remover.

WM. B. PIERCE CO. 319 Washington Street, Buffalo, N. Y.





### The Right Kind of a MOTOR

on land or water. Double Cylinder Motor 4½x5. Water Jacket Cylin-ders and Head. Aluminum Crank Case, Self-Oiling, Nickel Steel Val-ves. Forged Steel Shaft. Can fur-nish Transmission Gro. Carburet-ter and Muffler. Cut on application.

"COMMERCIAL CALCULATOR." weights measures, tables, and calculations for every business worked out ready for instant use. No business man, mechanic, apprentice or office man can afford to be without it; send 50c. to Tunis Mfg. Co., 708 Chestnut St., Phila., Pa.



## NOISELESS **Bevel Pinions**

We can furnish our New Process Noiseless Pinions in bevels as well as spurs of any size wanted and to transmit any required horse power. Write for catalogue.

THE NEW PROCESS RAWHIDE CO. Syracuse, N. Y.

## Instructive Scientific Papers ON TIMELY TOPICS

Price 10 Cents each, by mail

HOME MADE DYNAMOS. SCIENTIFIC AMERICAN SUPPLEMENTS 161 and 600 contain excellent articles with full drawings.

PLATING DYNAMOS. SCIENTIFIC AMERICAN SUPPLEMENTS 720 and 793 describe their construction so clearly that any amateur can make them.

DYNAMO AND MOTOR COMBINED. Fully described and illustrated in Scientific American Supplements 844 and 865. The machines can be run either as dynamos protected.

ELECTRICAL MOTORS. Their Construction at Home. SCIENTIFIC AMERICAN SUPPLEMENTS 759. 761. 767. 641. THE MAKING OF A DRY BATTERY.

SCIENTIFIC AMERICAN SUPPLEMENTS 1001, 1387, 1383. Invaluable for experimental ELECTRICAL FURNACES are fully de-

scribed in Scientific American Supplements 1182, 1107, 1374, 1375, 1419, 1420, 1421, 1077.

VALUABLE PAPERS ON ACETY-LENE GAS are contained in SCIENTIFIC AMERICAN SUPPLEMENTS 1371, 1203, 1204, 1205, 1206, 1234, 1184, 1149, 1150. THE CARE OF ACETYLENE GAS is discussed in SCIENTIFIC AMERICAN SUPPLEMENTS 1189, 1444, 1289.

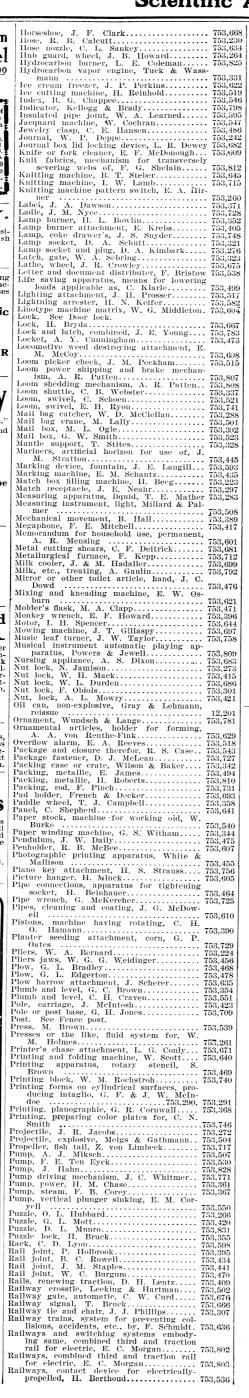
MISCELLANEOUS PAPERS ON ACETYLENE GAS will be found in SCIENTIFIC AMERICAN SUPPLEMENTS 1082, 1083, 1084, 1085, 1086, 1015, 1016, 1057.

Price 10 Cents each by mail

Order through your newsdealer or from

MUNN @ COMPANY 361 Broadway

New York



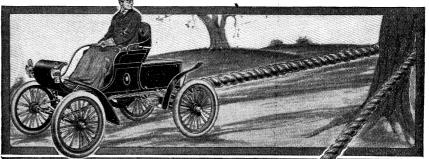


auto mobile absolutely unique in perfection of design and care. fulness of construction. No other is so easily and perfectly adaptable to the various re-

easily and perfectly adaptable to the various requirements of business and pleasure; no other has so many points of intrinsic uperiority. Improved wheel steering-gear; new departure in brakes; positive ignition. Transmission is simple, noiseless and "fool-proof." When car is running on high gear the speed can be regulated on ordinary roads by throttle alone. Engine develops eight horse-power, runs without vibration, and will drive steadily, surely, powerfully, "wherever a wheel will turn." Model A, 1904, with detachable tonneau, scatting four, all facing forward, \$850.00; without tonneau, \$750.00. All 1904 Cadillacs are equipped with Clincher Tires.

Our free illustrated booklet N gives address of agency nearest you, where the Cadillac may be seen and tried.

CADILLAC AUTOMOBILE CO., Detroit, Mich.



# You see them wherever you go They go wherever you see them.

The power of this compact and reliable gaso line motor of the Oldsmobile Standard Runabout is more than equal to the combined power of four strong horses. This wonderful piece of mechanism has made the Oldsmobile famous on five continents; and its superiority has been demonall kinds of endurance contests. It has given satisfaction to over 20,000 purchasers. It is built to run and

Note Our Range of Prices Standard Runabout,

\$650 Touring Runabout, \$750 Light Tonneau Car, \$950 Light Tonneau Car, \$950 Same without rear seat,\$850

For information, see selling agent, or write direct. Send stamp for automobile story, 'Golden Gate to Hell Gate."

Olds Motor Works, Detroit, U. S. A. Member of the Association of Licensed Automobile Manufacturers







Six different models \$0.00 to \$1,0.00 at metadoxy. Model "K" with four lamps and horn, \$1.200 at the factory. Same car fitted with canopy top, beveled plate glass swinging front and side baskets, Model "L" \$1,350 at the factory. Rambler Delivery Wagons, with detachable top, \$50 at the factory. Our new illustrated catalogue, shows each different siyle of ear and tells its special points of metit. Shall we mail you a copy?

Thos. B. Jeffery & Co., Kenosha, Wis., U. S. A.

## Mosler "SPIT-FIRE" Spark Plug



"Spit fire" when others spark only Fit any engine, any thread.

Mosler SPIT-FIRE

FINE CONTRACT WORK in wood and metal, and press work. Our optical work gives us unexcelled facilities for handling the highest grade of fine work in our Contract Department.

Correspondence solicited.

GUNDLACH-MANHATTAN OFT

GUNDLACH-MANHATTAN OPT. CO., Rochester, N. Y.



SHOE BLACKING.—FORMULAS FOR liquid and solid blacking are given in SUPPLEMENT Nos. 1213 and 1239. Price 10 cents each. For sale by Munn & Co. and all newsdealers





## OBER LATHES



For Turning Axe, Adze, Pick, Sledge, Hatchet, Hammer, Auger, File, Knife and Chisel Handles, Whiffletrees, Yokes, Spokes, Porch Spindles, Stair Baiusters Table and Chair Legs and other irregular

Send for Circular A. The Ober Mfg. Co., 10 Bell St., Chagrin Falls, O., U.S.A.

ELECTRO MOTOR. SIMPLE, HOW TO make.—By G. M. Hopkins. Description of a small electric motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Price 10 cents. To be had at this office and from all newsdealers.



## TYPEWRITERS ALL All the Standard machines SOLD on DEPARTMENT OF THE STANDARD SOLD on DEPARTMENT OF THE STANDARD SOLD OF THE STANDARD SO ination. Send for Cat.

**Brushless Painting** 

## proved method of applying paint, shingle stain or whitewash is with Patton's **Aereo-Painter**

The old way of covering a large surface with paint or whitewash, was with a brush. The im-

A remarkable invention. Simple in construction. No complicated parts to get out of order. Requires no experience to use it successfully. Saves time and money. Adapted for both outside and inside work. The 25 feet of hose and side and inside work. The 25 feet of hose and 7-foot nozzle pipe, reaches any part of a building without the use of scaffold or ladder. Send for free descriptive circular.

PITTSBURCH PLATE CLASS CO. PATTON PAINT COMPANY 227 Lake St., Milwaukee, Wis.

## FAY & BOWEN Motors & \_ Launches

Operated by **GasolineVapor** Motors 1/2 to 25 H.P.

The Fay & Bowen Marine Motor is a revelation to those wno have used others. Reliable, safe, durable and easy to operate. Remarkable speed control. Best of all, its starts when you start it. No handle or crank is used. Our patented igniter is absolutely unique and always instant and positive in action. It is really the only perfect and satisfactory igniter. suistancing igniter.

otors complete from 1½ to 25 h. p. ready for installation.

also build handsome launches with motors installed and

eady to run. SEND FOR CATALOGUE.
Fay & Bowen Engine Co., 35 Mill St., Auburn N. Y,



AUTOMOBILE JACKS. Simple. Easily operated Capacity, 2,500 pounds. Unbreakable. Price, each. \$2.00.

O. K. MACHINE WORKS 75 Ellicott St., Buffalo, N. Y.



The SUN Typewriter No. 2

Perfect in Mechanical
Action.
It is a type
bar machine. It has visible
writing in its truest form.
It has unlimited speed. It
has an anti-ribbon inking mechanism. It is
a heavy manifolder.
A high-grade writing machine sold for
\$40. Call and inspect,
or write for catalogue.

LITER. COMPANV.

SUN TYPEWRITER COMPANY, 239 Broadway, - New York.

## EveryMechanic Should Own It.

Montgomery & Co.'s Tool Catalogue which is thoroughly up-to-date. 704 pages and discount sheet. Sent by mail for 25 cents.

MONTGOMERY & CO., 105 Fulton St., New York City. GATALOGUE Nº21





## The Franklin Dynamo

50 Watts, 10 Volts, 5 Amperes 3000 to 4000 revolutions. Sets of material, finished parts, complete machines. For amateur construction, very efficient. Will drive a dental engine, sewing-machine or small lathe; run as a generator, will furnish current for six 6-candle lamps. Parts \$3.50, \$8.00, \$8.50, Complete \$13.50. Write for circular 9.

Parsell & Weed, 129-131 W. 31st St., N. Y.

## MASON'S NEW PAT. WHIP HOISTS

Manfd. by VOLNEY W. MASON & CO., Inc. Providence, R. I., U. S. A.



Auto-Sparker does away entirely with all starting and running batteries, their annoyance and expense. No belt—no switch—no bat-teries. Can be attached to any engine now using batteries. Fully guaranteed; write for descriptive catalog.

Motsinger Device Mfg. Co., 14 Main St., Pendleton, Ind.

Soot Proof



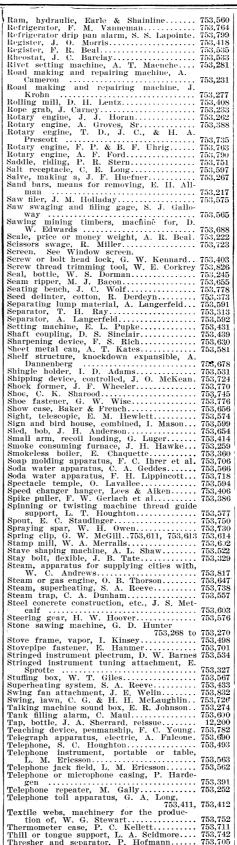
C. A. MEZGER, 203 W. Soth St., New York



PSu USE GRINDSTONES? If so we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. \*\* Ask for catalogue.

The CLEVELAND STONE CO. 2d Floor, Wilshire, Cleveland, O.

A SIMPLE KEY TO THE CHANGES OF THE WEATHER. By D. A. N. GROVER, author of "Heat, or Repulsion the Force of Gravitation and the Only Physical Force in the Universe." Price Fifty Send to Acoma Publishing Company, Typewriter Emporium. 203 LaSalle St., Chicago Kansas City, Mo.



Wilkinson 753,774
Turbine governing mechanism, J. Wilkinson 753,774, 753,773
Turbine supply nozzle, C. Weichelt 753,773
Turbine supply nozzle, C. Weichelt 753,378
Typewriter aliner, J. Alexander 753,338
Typewriter alining mechanism, J. Alexander 753,348
Typewriter, polychrome, Joerissen & Livingston 753,797
Typewriter type her segment C. W. How

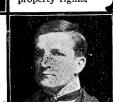


IF YOU SHOOT A RIFLE Pistol or Shotgun, you'll make a Bull's Pistol or Shotpun, you'll make a Bull's Eve by sending three 2c. stamps for the Ideal Hand-book "A," 126 pages FREE. The latest Encyclopedia of Arms, Powders, Shot and Bullets. Mention SCIENTIFIC AMERICAN. Address IDEAL MFG. CO., 26 U St., NEW HAVEN, CONN., U.S.A.



WILL, give an opinion covering the full legal status of any question upon which you are in doubt affecting your business, family, personal or property rights.

Send me one dollar, stating the facts of your case, and I will forward a full opinion, without further charge. A. B. Gordon-Davis, Attorney and Counselor at Law 892 Counselor at Law, 823 Mutual Life Building, Philadelphia, Pa.



LEAD PENCILS, COLORED PENCILS, SLATE PENCILS, WRITING SLATES, INKS, STATIONERS RUBBER GOODS, RULERS, ARTISTS' COLORS.

78 Reade Street, New York, N. Y. GRAND PRIZE, Highest Award, PARIS. 1900.



## Carriage Motors

For Bicycle, Contact or Jump Spark One Piece Casting. Light Weight. Large Bearing Sur-aces. Write us to-day GRANT-FERRIS CO.

## MARINE ENGINES

1, 2, 3 and 4 Cylinder Launches

Send for



GRAND RAPIDS GAS ENGINE & YACHT CO. Grand Rapids, Mich.



PRINTING TAUGHT FREE With every Model Printing Press and outfit (cost \$\frac{5}{8}\$, and up) we give free a complete course in the art of printing. While you're learning you can make money at home by printing for others. Write for particulars, and catalogue No. 10. Three World's Fair Highest Awards. THE MODEL PRESS 708 Chestnut Street, Philadelphia.

## BUILDYOUR OWN BOAT BY THE BROOKS SYSTEM

TO EXACT SIZE PATTERNS. COMPLETE IN THE PATTERNS HAVE BUILT THIS COMBINATION OF THIS BOAT SAIL BOAT AND LAUNCH IN FOUR BUILT THIS COMBINATION OF THIS BOAT SAIL BOAT AND LAUNCH IN FOUR BUILT SAIL BOAT AND LAUNCH IN FOUR BUILT SAIL BOAT AND SAIL BOAT SAIL BO

BROOKS BOAT MFG. CO., STA. A . BAY CITY-MICH



The MEDART **BOAT BUILDING MATERIALS** 

Yachts, Launches, Row Boats. FRED MEDART, 3545 DeKalb St., St. Louis, Mo.



SEALS, BOTTLES, PACKAGES BOXES, PAPERS, CAR DOORS V Send for a sample of the great Twentieth

## SIGNATURE SEAL

THIS Seal has two parts—the Lock and Breakable Key. To seal any article, pass both ends of the wire through the eye of the block, turn key until it breaks off. Signatures may be written permanently with a pencil on one side of the block. Signatures may also be stamped or printed on the block. The stub of the key may be used to keep "tab" on the seals used, so that a count is easily kept by the sender. No tools necessary.

Write to-day for Literature.

D. K. HIETT, 185 Dearborn St., CHICAGO, ILL.



# Sore Throat!

To prove the wonderful urative powers of

to all afflicted with Sore Throat I will send

## One Trial Bottle Free

to anyone sending me 10 cents to pay postage. Hydrozone is a harmless germicide, which will cure vou.

Booklet on treatment of diseases sent free on request.

Sold by all druggists.

Prof. Charles Marchand Dep't U, 63 Prince St., New York

## What Is Daus' Tip-Top?



TO PROVE that Dans' "Tip Top" is the best and simplest diedee for making 100 copies from prownwitten and 50 copies from typewritten original, we will ship complete duplicator, cas without deposit, on ten (10) days' trial.

Price 87.50 less tradediscount of 33% per cent, or

The Felix F. Daus Duplicator Co., Daus Bldg, 111 John St., New York

CHIME HORNS for automobiles. The very latest imported French novelty. Send for one to-day. Special reduced price \$7.00 each.

O. K. MACHINE WORKS
75 Ellicott St., Buffalo, N. Y.

## PIPE-THREADING or CUTTING no machine on the market that can com-ease of operation and excellence of work For



FORBES PATENT DIE STOCK Vise is self-centering and dies are adjust ble to any variation of the fittings. Parts an be duplicated at slight cost when worn ut. Will thread and cut up to 12 in. pipe. CATALOGUE FREE. CURTIS & CURTIS CO... 6 Garden St., Bridgeport, Conn.



ROTH BROS. & CO. **DYNAMOS** from 2 to 300 Lights. MOTORS

from 1-32 to 20 H. P. Write for Bulletin No. 107 23 S. Clinton St. Chicago, Ill.



WONDER Acetylene Burners Price ARE THE BEST
40c. each. Sold by good dealers or write
6/16 STATE LINE MFG. CO.



Angle Benders

we make hand-power benders for forming an-gles in stock 1 in. thick and under. Light stock can be bent cold.

WALLACE SUPPLY COMPANY 910 Royal Insurance Building, CHICAGO

If You Want the Best Lathe and Drill







## Southern Home In a country free from excessive heat and cold, healthful and prosperous.

## LANDS at LOW PRICES

For printed matter, circulars, etc., giving full particulars, write

M. V. RICHARDS, Land and Industrial Agent. M. V. KIUHARDS, James Southern Railway and Mobile & Ohio Railroad.

Washington, D. C

## PERFECT - PUMP - POWER.



is attained only in the TABER ROTARY PUMPS

#### DESIGNS.

Cash registering cabinet or casing, E. Rin-	
gold	36,831
Chain, watch, J. Hama	36,825
Dish, J. Maddock	36,830
Monument, E. M. Wolff	36,832
Spoons, forks, or similar articles, handle	
for, E. Crees and C. S. Court. 36,826 to	36,828
Tableware, open work border for metallic,	
A. Steffin	36,829

### TRADE MARKS.

Brown & Allen
Lozenges or throat tablets, bronchial, L.
J. Gerson
Lubricants soluble in water, Fuller & Jones
Medicine for certain named diseases, liquid,
S. R. Burford.
Napkins, sanitary, Seabury & Johnson
Paper and envelops, writing, F. J. Marshall
Powder books, paper, A. S. Butler.
Razor strops, Weiffenbach Mfg. Co.
Razors, safety, Reichard & Scheuber Mfg.
Co.
42,187,
Remedy for expelling worms from the system, Lanman & Kemp.
Shades and shade fabrics, window, B. Price
Suspenders, men's, L. Oppenheimer's Sons.
Thread, sewing, Jonas Brook & Bros.
Witch hazel or hamamelis, extract of, Lanman & Kemp. 42,170

## LABELS.

LABELS.

"Bald Eagle," for axes and edge tools, Mann Edge Tool Co.
"Boneset and Wild Cherry Expectorant," for medicine, R. Burkhardt.
"Colonial," for axes and edge tools, Mann Edge Tool Co.
"Crown," for creamery butter, F. H. Arnsburger
"Fifteen Years Old Manassas 1861 Pure Rye Whisky," for whisky, P. McIntyre "Grippura (Germ Destroyer)," for a medicine, A. Crichton.
"Hedeval," for hog cholera cure, American Hog Cholera Cure Co.
"John Lord," for cigars, Grand Rapids Cigar Box Co.
"Khedive," for tea, Milliken, Tomlinson Co.
"Mann's Superior," for axes, J. H. Mann.
"Migridine," for deientry Hair & Skin Tonic," for a toilet preparation, J. M. Aboussleman
"Nigridine," for medicine, F. C. Reighter.
"Persian Rose Pomade," for a toilet preparation, J. M. Aboussleman
"Red Top," for axes and edge tools, Mann Edge Tool Co.
"Roelefette," for hats, H. I. Ireland.
"Scale Off Boiler Compound," for boiler compound powder, Howard Chemical Co.
"Shammock," for tea, Milliken, Tomlinson Co.

10,793 10,779 10,795

## PRINTS.

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 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York. TABER ROTARY PUMPS
They are mechanical simple and durable. Will pump hot or cold fluid, thin or thick. Requires no skilled mechanic Most interchangeable. Made of income, steel or bronze. Can be driven by belt, motor or engine attachment. Large flustrated Catalogue free TABER PUMP CO., 32 Wells St., Buffalo, N.Y., U. S.A. address Munn & Co., 361 Broadway, New York.

A printed copy of the specification and drawing fan pump to the form part in the foregoing list, or any patent in the forego

# ERFORATED MET OF EVERY DESCRIPTION AND FOR ALL; USES. 15 HARRINGTON & KING PERFORATING CO., 225 N. LINION ST., CHICAGO, ILL. U.S.A.



Saving Shaving—

You not only save money by shaving yourself with the always ready and smooth working

## Gillette Safety Razor

But you save no end of annoyance and bother. No stropping, no honing, no danger of cuts—no lost time or health risks in barber shops. Each razor has 20 double-edged blades—is good for 400 shaves. We rehone the twenty for 50 cents. If not satisfied after trial, money refunded. If not at your dealer's write for booklet. Correspondence solicited from dealers. Exclusive territory will be given. GILLETTE SALES CO., 1207 Manhattan Building, CHICAGO.

SPECIAL LOW RATES VIA THE NICKEL OPINITE ROAD

to points in the West and Southwest. One way Colonist and round trip Homeseekers' tickets on sale first and third Tuesdays of each month to April inclusive. See local agents, or write R. E. Payne, General Agent, Buffalo, N. Y., or A. W. Ecclestone, D. P. A., 355 Broadway, New York.



EASTERN GRANITE ROOFING CO. Irving Building



42,164 42,171 42,181

42,188

10,797

10,783

10,787

10,797 10,784 10,786

10,789 10,794

10,782

10,798 10,780

WHAT Schapirograph?

THE DUPLICATOR that cleanly multopies anything written with pen or typewriter, a music, drawings, etc. One original gives 150 cop BLACK ink in 15 minutes. A VOIDS stenwarding delays, and expensive supplies. Pricomplete, cap-size outfit, \$8,00. Lasts for yea Sent on 5 DAYS FREE TRIAL without SCHAPIROGRAPH CO., 265 Broadway, New Young the property of the property of

## INVESTORS

desiring to realize the Large Interest and Profits possible in legitimate Mining, Oil, Timber & Smelter Investments and Dividend-paying Industrial Stocks, listed and unlisted, should send for our Booklets, giving full information, mailed free.

Booklets, giving full information, mailed free. **DOUGLAS, LAGEY & GO.,**Bankers & Brokers, 66 Broadway, New York

Che TYPEVRITER LIKE RADIUM IS



Send for booklet, which explains why

## The Smith Premier Typewriter Co.

Executive Office 287 Broadway, New York Factory

Branches in all large cities

#### GROUND **FLOOR** PROPOSITION

We own a patented device which will revolutionize existing methods of Ventilation. Humidification and Refrigeration. Scientifically correct. No competition. We will sell a limited number of treasury shares. Small capitalization. All common stock. No Bonds. No Mortgages. Write for particulars.

REGENERATED COLD AIR CO.
147 Milk Street Boston, Mass.

## **Export Trade**

How to Secure and How to Hold It

Valuable hints on how to secure Export Trade sent gratis on request. Address

EXPORT EXPERT Box 773, New York

DIES AND STAMPINGS TO ORDER.
SPEC'L MACHINERY-MODELS-EXPERIMENTAL WORK
DROP FORGING DIES AND DROP FORGINGS.
HADDWARE SECOLUTIES AND AND TORDERS SEND SAMPLES

and Bottlers Machinery. THE VILTER Machinery. THE VILTER Clinton St., Milwaukee, Wis.

MODELS & EXPERIMENTAL WORK.
Inventions developed. Special Machinery.
E. V. BAILLARD, Fox Bldg.. Franklin Square, New York.

SPECIAL MACHINERY Tools and Dies. Model & Experimental Work. Costilo Machine Works, 60 Centre St., New York.

## **Experimental & Model Work** Cir. & advice free. Wm. Gardam & Son. 45-51 Rose St., N.Y.

ELECTRICITY HOW TO MAKE. A Dynamo, Storage Battery, Telegraph Instrument, Electric Bell, Motor. 5 Books, 10c. each. BUBIER PUBLISHING CO., Box S. LYNN, MASS.

Dies, Tools and Special Machines. Models and Experimental Work. General Machine Work. Ph. J. Bender & Sons, Inc., 87 Frankfort St., New York

CHEMICAL EXAMINATIONS OF ALL KINDS.
DR. H. C. STIEFEL, Bissell Block, Pittsburgh, Pa.

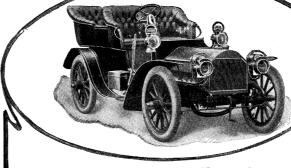
NOVELTIES & PATENTED ARTICLES MANUFACTURED BY CONTRACT. PUNCHING DIES, SPECIAL MACHINERY. E.KONIGSLOW STAMPING & TOOL WORKS, CLEVE LAND, O.

## MECANIQUE & MOTEURS

Rue Lairesse, No. S3-S5, Liége, Belgium MOTORS, MOTOR CYCLES, MOTOR CARS, FITTINGS AGENT WANTED

Gas Engine Complete with spark coil, \$12.00. The **Best Thing** on the market. Latest and most improved model.

Send for Circular. Carlisle & Finch Co., 233 E. Clifton Av., Cincinnati, O.



The Joys of Touring

Come in fullest measure to those who know the sense of absolute safety, the thrill of measureless speed, and the feeling of luxurious comfort that abound in

Peerless Drive Touring Cars \$3,700 to \$6,000

Peerless Cars are easy to handle. They are sent out Ready to Run and Stay So

Photogravure of the "Peerless Girl V" here illustrated, size 18x29 inches, without advertising and suitable to frame, mailed you for 10c stamps or coin. Write for new illustrated catalog

The Peerless Motor Car Company, Cleveland, Ohio.



THE WINTON MOTOR CARRIAGE CO., Cleveland, U.S.A.

# **Orient Buckboard**



Model of 1904. With TWO SPEED. Price \$425.

WALTHAM MFG. CO., Waltham, Mass.





BRIDGE WHIST

BRIDGE V	٧į	11	S	T	The Boston Bridge Whist Score Block
		-	1 0		Transe Each block con-
One Yrick	2	4	6	1 8	
a Monors	4	T A	12	18	
1 Hopers	8	18	24	32	40 sheets, size 41/x3.
5 Honors	10	20	30	40	
4 Henors in one hand	16	32	48	84	loo Also a complete
4 Honors to one hand and 5th in partner's hand	18	36	54	72	set of Bridge rules.
5 Honors in one hand	20	40	60	80	
Little Slam adds	20	20	20	20	Postpaid on re-
Big Slam add	40	40	40	40	40 cent of twenty-five
No trumps in one hand reduces Honors to adversary's	4	8	12	16	
No trumps to one hand increases Honors In pertoer's	4	8	12	16	cents.
	-	***************************************		Annual Printer	D 117 D

Each block contains one hundred sheets, size 4½x8. Also a complete set of Bridge rules. Postpaid on recept of twenty-five cents.

POINTS. HONORS. 220 Devenshire St Boston, Mass.

Snowflake—Aromatic—Pine Scented Camphor Substitute

# Chemical Camphor

Pure, White, Recrystallized. In One Pound Packages.

An effective and economical substitute for Camphor, Carbolic Acid and Tar Paper and other protectives against Moths, Mildew and Infection.

Prevents and destroys Buffalo
Bugs and
Mice.

DIRECTIONS - Sprinkle LIBERALLY among the articles to be protected, and wrap tightly in paper or put away in closet or chest. The CHEMICAL CAMPHOR will not injure the finest fabric if properly used, and the odor will quickly disappear on exposure.

1 lb. sent by mail, 35c., or you can purchase 2 lbs. for 25c. of your nearest druggist. Be sure and specialize Metcalf's Chemical Camphor.

THEODORE METCALF CO.

BOSTON, U. S. A.

New York. E. FOUGERA & CO.

Chicago, PETER VAN SCHAACK & SONS San Francisco, REDINGTON & COMPANY



FOR AUTOMOBILE TRANSMISSIONS AND RUNNING GEARS

0. K. MACHINE WORKS 75 Ellicott St., Buffalo, N. Y.



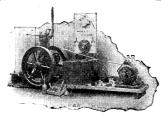
# WONDER of the AGE

1,000 feet or more and maintain an efficiency of from 70% to 84%.
First choice of the Engineer for City Water Works, Draining Mines, Hydraulicing, Irrigating and Reclaiming Land.

Durability, Economy and Efficiency.

Catalogue No. 6.

BYRON JACKSON MACHINE WORKS, - - SAN FRANCISCO, CAL



## Have Your Own Electric Light Plant

Our electric light outfits are complete in every detail, ready to set up and use either in Yachts, Summer Homes, Isolated Situations, or Anywhere. Same engine can be used to furnish power for other purposes as well. They are practical and so simple that no electrician is required to run them. For interesting booklet showing all sizes, address

ELECTRIC DEPARTMENT RICHARDSON ENGINEERING CO., Hartford, Ct.



The  ${\sf APPLE}$ Saves battery troubles, attached to any gas engine. Governors, Storage and Dry Batteries, Spark Coils, Plugs, Switches, Automatic The Dayton Electrical Mfg. Co. Oynamio 98 Reibold Bidg., DAYTON, O.



Scientific Disinfecting House. Stable, Kennel and Launch Carbo Negus Cleans
To CLEAN is to KILL Germs

Any druggist, or trial bottle 10e. by mail. A. C. DANIELS, St., Boston, Mass.



Sold Everywhere.



Actual 22 horsepower, with only 85 lbs. loaded weight to each horsepower. Speed range of 4 to 40 miles per hour. Anti-friction ball bearing axles, direct drive, mechanical valves for intike and exhaust. Winnof highest prizes for **HOTH** speed and endurance wherever entered. \$3,000.

PACKARD MOTOR CAR CO., Dept. 5, Detroit. Mich.
Member Association of Licensed Automobile Manufacturers. ew York Agents:—PACKARD MOTOR CAR Co., of N. Y., 317-319 W. 59th St., New York City.



#### ASBESTOS CRUDE DIRECT FROM MINES

PREPARED

R. H. MARTIN, ASBESTOS FIBRE OFFICE, ST. PAUL BUILDING for Manufacturers use 220 B'way, New York.

# MFR OF CRUCIBLE SHEET STEEL WASHINGTON PA.

TERMINALS. A new detachable kind for autos You do not have to loosen screws on spark plug to detach cable from engine. Ten cents

o. K. MACHINE WORKS
75 Ellicott St., Buffalo, N. Y.



THE IDEAL BED For Home, Camp, Yacht, Hospital Non-Absorbent-Hygienic-Odorless

Non-Absorbent—Hygiente—"doorless
When deflated can be rolled into small package for storage
or transportation"
NO CAMPING OUTFIT COMPLETE WITHOUT THEM

"Perfection" Air Cushions
For Office, Easy, and Invalid Chairs, Yachts and Small Boats.
Send for descriptive booklet "A" and price list.

MECHANICAL FABRIC CO. Providence, R. I.

lemple Clasps If You Value Your Eyes Never Hurt You should wear

THE BRIGGS IMPROVED TEMPLE CLASPS

the only really comfortable glasses that Don't Pinch the Nose, Don't Pull Your Ears, Don't Make Your Head Ache, and Don't Fall Off, as other glasses do. They are the only glasses that always rest the eyes—as they enable you to look through their centre always.

Everybody who wears glasses or has eye weakness needs our Book on Eye Logic. It is FREE. Write for it. Briggs Optical Co., 344 Triangle Bldg., Rochester, N. Y

Not in the Front Rank. It is the Leader 21/2 H. P. Single Cylinder Motor Cycle

ng Life



Climbs all ordinary hills. To the front in Club Runs Price \$200. With Grip Control, \$210 C. H. CURTIS MFG. CO. Hammondsport, N. Y

# 5,000 sq. ft. of BLUE PRINTS in 24 Hours

THE FRANKLIN AUTOMATIC CONTINUOUS FEED ELECTRIC BLUE PRINT MACHINE prints continuously by Electric Light, day or night. Handles tracings of any length, size or kind. The tension is automatic and does not depend on skill of operator. Used by largest railroads and United States Government. Patented in United States, Canada and Europe. Made in two sizes, for 36 and 42-inch tracings. Send for descriptive circular. WILLIAMS, BROWN & EARLE, Dept. L, 918 Chestnut St., Philadelphia.







### THE TWO-SPEED GEAR CHAINLESS BICYCLE

Enables the rider, by a slight pressure of foot on pedal, to change from high to low gear for hill climbing and difficult roads.

difficult roads.

Eastern Department, Hartford, Conn.
"Columbia" "Cleveland" "Tribune" "Crawford"

Western Department, Chicago, Ill.
"Crescent" "Rambler" "Monarch" "Imperial" Catalogues free at our 10,000 dealers' stores, or any one Catalogue mailed on receipt of a two-cent stamp.

All varieties at lowest prices. Best Kallroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Sav. Lists Free. CHICAGO SCALE CO., Chicago, Ill





AMERICUS

The New England Watch Co.

NEW YORK OFFICE:

57 & 39 Maiden Lane

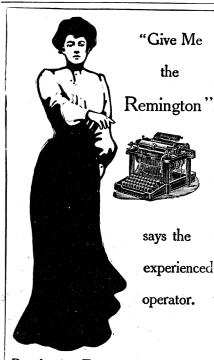
7 Snow Hill

#### HOROLOGICAL DEPARTMENT BRADLEY POLYTECHNIC INSTITUTE



Formerly Parsons Horological Institute PEORIA, ILLINOIS LARGEST and BEST WATCH SCHOOL in AMERICA We teach Watch Work, Jewelry, Engraving, Clock Work, Optics. Tuition reasonable. Board and rooms near school at moderate rates.

Send for Catalog of Information.



Remington Typewriter Company 327 Broadway, New York.