

**Census Inquiry Regarding Canals.**

The prompt and careful responses to the recent request by the Director of the Census, for information relating to canals and ditches, indicate that the importance and value of a complete and accurate census of irrigation are appreciated by those engaged in this branch of agriculture.

Director Merriam is very well pleased with the great interest evinced in the work of collecting data, and is confident that with the continued assistance of the irrigators and the press, the present investigation will be a success.

The returns from the preliminary inquiries furnish evidence of the material progress made in arid America and give promise of an advance in the twentieth century exceeding the wonderful development of the Mississippi Valley during the past decade. The boundary line, which so long has divided the arid and humid regions, will no longer stay the onward march of agriculture. To-day it is realized that just beyond that line lies an empire greater and far more resourceful than any yet conquered. With the narrowing of the unoccupied limits of government lands in the humid zones the question of reclaiming the arid and subhumid regions grows in importance, and is to-day claiming the attention of the wisest minds of the nation.

Many of the preliminary schedules sent out in December and January have been received and are already tabulated. The mailing of the principal schedules is being pushed as rapidly as possible.

The questions in this schedule are numerous and important. Director Merriam requests that they be carefully answered, as upon these answers an accurate and perfect census of irrigation largely depends.

The scope of the present inquiry is broad. Its purpose is to determine the present conditions and results of irrigation, and to tabulate the same in such a manner that they may be fully comprehended by every one. Such a work successfully conducted, will result in bringing about a more complete realization of the fact that the development of irrigation is affecting the prosperity of our nation as well as the progress and stability of many Western States.

**Geography and Exploration in 1899.**

No great geographical discoveries have been recorded during 1899, but a great deal of exploration work has been accomplished. Considerable interest has been taken in preparing expeditions of Antarctic research, of which the Belgian expedition has returned with some important results. Mr. Borchgrevink has begun his work at Cape Adar on the Antarctic mainland. The search for Andrée has helped to increase our knowledge of parts of the Arctic coast, says Popular Science Monthly. In Asia, Captain Deasy has laid down the whole of the course of the Yarkand River, which was before unknown.

The expeditions sent out by Canadian surveys are constantly opening up new country and the maps produced are of great value. Mr. A. P. Low, finds Labrador to be a country less bleak and hopeless than has been generally believed. Sir William Martin Conway has done some very creditable explorations in the Andes and in Tierra del Fuego the scientific results of which are of considerable value. In Chili, Dr. Staffer and his colleagues have explored the wonderful fiords of the coast and rivers which came down to them from the Andean range. Dr. Moreno has described the results of twenty-five years' exploration of the great Patagonian plains, and the readers of the SCIENTIFIC AMERICAN will remember the article which was recently published on Prof. J. B. Hatcher's explorations in Patagonia. One of the most important scientific enterprises was the German oceanographical expedition in the Valdivia under Prof. Chum, which went south through the Atlantic to the edge of the Antarctic ice and north through the Indian Ocean to Sumatra, and home through the Red Sea.

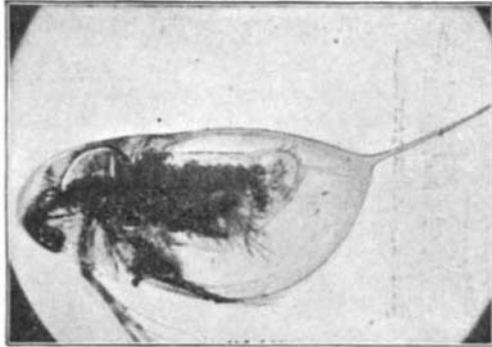
**Old Stage Effects.**

We are apt to consider that stage effects are an invention of the present century. This may be so in some cases, but many of them are very old. The lime-light is probably the most valuable accessory for modern stage effects. It was introduced some time around 1837 or 1838, and was regarded as a great curiosity. Its expense, however, prevented its being used to any extent for a long period. In 1480, intricate machinery was regularly used in religious plays for the simulation of various natural phenomena. Earthquakes always seem to have been the most pleasing and taking of effects, and we hear of them as far back as 1692, when Evelyn refers to a puppet show in which an earthquake effect was used. The old paper snow for winter effects was largely abandoned, and in France waste clippings of glove manufacturers are used instead. The white glove clippings fall better in the air than small pieces of paper, and they cling better to the scenery and to the actor's garments as they descend. The ordinary nautical effects are of considerable antiquity. Full-rigged ships were in use in Paris as far back as 1713.

**A NEW APPARATUS FOR INSTANTANEOUS PHOTO-MICROGRAPHY.**

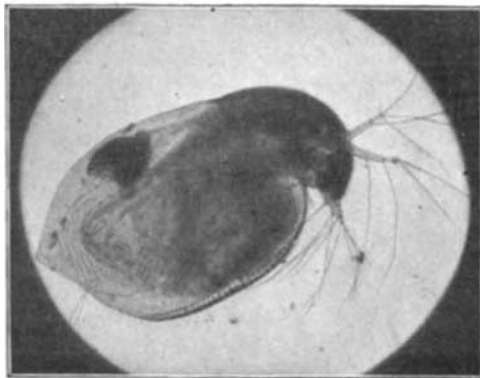
BY PROF. A. C. SCOTT.

The subject of photo-micrography is alike important to both biological and physical science. It involves not only accurate and interesting work with micro-



COPEPOD, 200 DIAMETERS, 1-35 SECOND EXPOSURE.

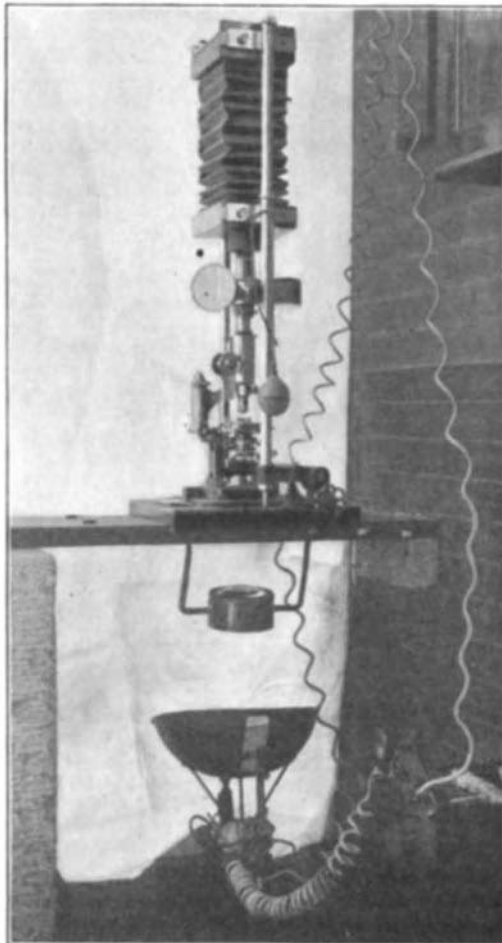
scopic organisms, but from the physical which includes the photographic side, much care is required in the selection and manipulation of the proper microscopic lenses, in connection with the source of light employed, stain used upon the subject to be photographed, if a mounted slide, and the chemistry necessarily connected



COPEPOD, 250 DIAMETERS, 1-40 SECOND EXPOSURE.

with the handling of the photographic plate itself, in order to obtain the best results.

The different general methods employed in this work together with proper magnification for certain forms, kind of illuminant, with ray filters, exposure, and character of plate, require separate treatment, as the chief



APPARATUS FOR INSTANTANEOUS PHOTO-MICROGRAPHY.

object of this article is to describe a new apparatus for making instantaneous photographs of living microscopic animals.

After having worked upon photo-micrography for some time for the purpose of obtaining photographs of microscopic slides for illustration with the optical lantern, and having determined the conditions requisite to the production of good results with mounted slides,

the thought occurred to the writer that if an instantaneous photograph of a living organism could be made, it might be valuable to the biologist and instructive to the physicist.

It will at once be apparent to those who have worked along this line that a powerful light is necessary for instantaneous work; in my own work with the apparatus an arc light consuming 2,200 watts is employed which gives, in the position used about 4,000 c. p. This light, as will be seen from the picture of the apparatus entire, is placed at a distance a little greater than the focal length of a condensing lens, so that the intensity of light upon the object and objective is considerably greater than would be the case without the lens. Of course a different position of the lens and light would magnify the intensity of the light greatly, but that is undesirable beyond a certain limit as the heat would be detrimental to the microscope objective.

With the proper arrangement of the light the essential feature in making the instantaneous photographs shown herewith is the combination shutter and view tube which is made to be clamped by means of three thumb screws to the draw tube of the microscope. This apparatus is fastened on after the ocular has been inserted in the draw tube. The mechanism of the apparatus is as follows:

Upon a movable brass plate inside a light tight box, (shown in Fig. 1, just below the camera bellows) is a 90-degree prism mounted in such a way that all of the light which passes through the microscope is projected upon a piece of ground glass at the end of a cone, which may be lengthened or shortened in order to give correct focus to the object here, when it is properly focused upon the ground glass of the camera directly above the microscope. Next to the prism is a hole in the brass plate for allowing light to pass from the microscope directly to the photographic plate when the prism is moved by means of a spring and pneumatic release, and finally a sufficient amount of the solid brass left to cover the opening when exposure has been made.

To take a photograph the microscopic animal is placed in a drop of water upon a suitable glass plate, the light is turned on and the shutter so set that the object may be focused upon the ground glass of the cone. The plate holder is inserted and the dark slide drawn leaving the plate exposed inside the camera bellows. The movements of the animal are easily seen upon the ground glass and when the desired position is obtained the shutter is released, the prism moves out of the way, and the light passes to the plate. Cramer's isochromatic plates have given the best satisfaction with this instantaneous work. Although the apparatus is not perfected to the writer's complete satisfaction, exposures as short as  $\frac{1}{10}$  of a second have been very satisfactory. Neither of the negatives whose prints are shown with this article had more than  $\frac{1}{2}$  of a second exposure. It seems perfectly possible with good microscope objectives and the best arrangement of illuminant to obtain thoroughly satisfactory negatives in  $\frac{1}{100}$  of a second.

The apparatus may be of some value other than photographic to biologists from the fact that it allows one to study the movements of a living microscopic organism with both eyes with perfect ease instead of by the common one-eye method which is apt to be tiresome.

**The Water System of Pompeii.**

Pompeii, like most Roman cities, had an excellent water system, but we are able to judge of the systems in other places only by the small remains, but in Pompeii, the whole system has been laid bare, and in "Pompeii, Its Life and Art," by August Mau, translated by Prof. Francis W. Kelsey, there is an interesting description of the water supply of the city. Remains of the great aqueduct near Avellino, a dozen miles east of Nola, have been discovered, and this aqueduct followed the base of Vesuvius and furnished water to Naples, Puteoli, Baiae and Misenum, but the source from which Pompeii received its water supply has not been discovered. The construction of the older baths showed that a free use of water was contemplated. There were many fountains along the streets, most of them at the corners. They were filled by pipes connected with the water system of that city, and these fountains bear witness to long use by depressions which have been worn in the stone by the hands of those who leaned forward to drink. Water towers were found at the sides of streets, they were small pillars of masonry which were raised to the height of 20 feet. There was a small reservoir of water on the top, presumably of metal. In all the houses of any size and importance there were flowing jets. Thus, in the famous house of the Vettii which was discovered a few years ago there are no less than sixteen jets, and water was not stinted in any of the three baths which have been discovered. The water-pipes were made of sheet lead folded together, the transverse section somewhat resembling that of a pear. Their size was regulated by the pressure and the water was turned on and off by stop-cocks which were much like those in use to-day.

**Trinity House, London.**

On Tower Hill, London, near the mint is "Trinity House," a corporation for the increase and encouragement of navigation, the examination of pilots, the regulation of lighthouses and buoys and, indeed, all naval matters not under the express jurisdiction of the Admiralty.

This corporation has a most curious and interesting history, and it has large powers which in this country are vested in the Treasury Department. Trinity House was founded by Sir Thomas Spert, Comptroller of the Navy to Henry VIII. It was incorporated in 1529 by the name of "The Master Wardens and Assistants of the Guild, or Fraternity of the Most Glorious and Undividable Trinity of St. Clement in the Parish of Deptford Stroud, in the County of Kent," and the parent establishment which was pulled down in 1787 was built at Deptford. In 1680, its first lighthouse was erected. Formerly all the lighthouses on the English coast had been built by private individuals under a patent from the crown. Indeed, it was not until 1854 that the private rights in the lightdues were abolished and the exclusive right of lighting and buoying the coast given to the Trinity Board. Among their other duties are to bind and enroll apprentices to the sea, examine the mathematical boys of Christ's Hospital, examine the mathematical masters for the navy and place or alter all the buoys, beacons and sea marks along the English coast, also for the channel of the Thames and other ports. To them also once belonged the power of ballasting all ships going out of the Thames, the ballast to be taken from the more dangerous shoals and where the river needed deepening, and at request masters of ships they could also certify that goods had been badly stowed. They could also prevent foreigners from serving on board British ships without licenses. They heard and determined complaints by officers and men in the merchant service and they could punish seamen for mutiny and desertion. Like all old institutions of this kind there were many curious by-laws. Thus, every master homeward bound was to unshot his guns at Gravesend under penalty of a fine of twenty nobles.

The corporation consists of a master, deputy masters, thirty-one elder brethren and an unlimited number of humbler members. The elder brothers are generally selected from old commanders in the navy and merchant service, and now and then a compliment is

paid to a prince or a nobleman by his selection, although as Walter Thornbury aptly remarks, "they could not steer a collier to Newcastle." The revenues of the corporation are very large. A number of years ago they amounted to \$1,500,000, and they probably now much exceed this sum. They are obtained from tonnage dues, ballastage, beaconage, and licensing pilots, and this sum after defraying the expenses of the lighthouses and paying off the portion of debt incurred by the purchase of all existing private rights and lighthouses, is chiefly expended in maintaining poor disabled seamen and their widows and orphans by pensions in the corporation hospital at Deptford, Stroud, which the masters and brethren visit in their state yacht in grand processions on Trinity Monday. The powers of Trinity House in old times were much greater than at present and they decided many maritime cases which were referred to them by the Admiralty judges. Some of their regulations now appear to be ridiculous. At one time every mariner who swore, cursed, or blasphemed on board ship, was by their rules compelled to pay one shilling to the ship's poor box; no mariner, unless sick, could absent himself from prayers without forfeiting six pence. The building contains many interesting memorials. It is of the Ionic order and was built in 1793-95 by Samuel Wyatt. The interior contains busts and portraits. The museum contains a flag taken from the Spanish Armada by Sir Francis Drake.

**Objection to Wire Nails.**

Strange to say the industry of making cut nails from iron and steel is having a great revival. The introduction of steel wire nails made great inroads upon the cut nail business, but now the latter shops are adding new machinery and enlarging their facilities. The increased demand is caused by the fact that shingles that have been fastened on barn roofs for the past ten years with wire nails are blowing off and farmers are greatly exercised over the matter.

The shingles fastened with the old cut nail remained on the roof until the shingles rotted, whereas with the steel wire nail, the shingle blows off after ten years. The main trouble with the steel wire nail, says The Evening Post, is that it cannot stand the weather as the wrought iron nail does. This is partly caused by the acid used in annealing the wire before it is drawn which cannot be thoroughly cleaned off. The Water-

viet Arsenal experiments show that cut nails have proved to be 50 per cent more adhesive when driven into wood than wire nails, but the bright and cheaper wire nails soon succeeded in making a great difference in the cut nail trade. The carpenter can drive wire nails too handily to return to the cut nails unless specifications actually require it, and the demands for cut nails are coming largely from agricultural sections. A big steel wire combine has had a special nail made with an extraordinarily large head and galvanized all over. These are guaranteed to outlast any nail in existence.

**A Vitriified Clay Church.**

A new church at Chicago, is built exclusively of vitriified clay, even the window frames are of the same material. The decorative features are white terra cotta. The altars, communion rail, pulpit and front of organ loft are all terra cotta. The entire ceiling is of brick and tile vaulting, the keystones being of terracotta and the ribs of the arches and groins of molded brick. There is not an inch of timber or a nail in the entire structure. Its acoustic properties are said to be remarkable.

**The Current Supplement.**

The current SUPPLEMENT No. 1264 is a most interesting issue. The "Prehistoric Ruins of Copan," is an elaborately illustrated article showing views of the site and the various finds. Some of the most important archæological work which is being done in America is being carried on at Copan. "Remedies for Snake-Bites: Scientific and Empiric" by A. W. Buckland, is a most valuable scientific paper. "The Weight of Air" is an article giving a graphic representation of the subject.

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**RECENTLY PATENTED INVENTIONS.****Agricultural Implements.**

**HAND-RAKE.**—MYLES Y. WARREN, Germantown, Philadelphia, Penn. To provide a rake arranged to discharge the gathered material from the teeth, is the purpose of this invention. The rake, with this object in view, is furnished with a cleaner movable on the teeth. A spring-lever is fulcrumed on the rake and engages the cleaner to move it up or down on the rake teeth. The spring-lever can be locked to hold the cleaner in an uppermost position.

**SICKLE-BAR ADJUSTER.**—MARTIN ANFINSON, Vermilion, S. D. This invention relates to a means for mounting the sickle-bar or cutting apparatus of a mower, so that these parts can be adjusted forward or backward to take up the wear on the pivots connecting the cutting-apparatus with the frame of the mower. On a coupling-arm an eccentric sleeve is mounted to roll. A bearing is mounted loosely on the sleeve and is provided with cutting apparatus. By rolling the eccentric sleeve, the bearing, and consequently the sickle and finger bars, can be adjusted forward or backward.

**Electrical Apparatus.**

**TELEGRAPH-SOUNDER.**—SAMUEL F. LIVELY, Alderson, W. Va. The device patented by the inventor is a double sounder, in which the two sounds are alike in tone or pitch, thus rendering the sounder distinct and clear. A pole-changer is provided, whereby the direction of the current-flow can be changed at will, thus enabling the operator to use the end of the lever for the downward stroke which happens to be the heavier. There is no spring resistance to be overcome, as in similar devices. The sounder automatically conforms to the fluctuations of the battery strength.

**Railway-Appliances.**

**CAR-REPLACER.**—JOHN C. BATES, Gilman, Colo. The purpose of the invention is to provide a simple, portable device, whereby a derailed car can be quickly directed to the rails of the track. The device is so constructed that the replacers can be turned end for end and interchangeably used, and that the wheels of a car can be conducted from the surface of the ground to a proper position upon the rails with the least possible resistance.

**RAILWAY.**—SANFORD P. DICKINSON and JOHN A. ROGERS, Corning, N. Y. In this railway the rails are mounted on continuous trusses, in turn supported by cross-ties formed with webs and base flanges, the cross-ties and trusses having certain peculiar features of construction by which the rails are more effectively mounted and secured than in the construction at present in use. The cross-ties comprise vertically-extended webs and horizontal base-flanges, the former having recesses formed in their upper edges. The trusses are horizontally set into the recesses and are provided with grooves in their upper faces. The rails have their base-flanges set in the grooves. The plates bear down on the base-flanges and are secured to the trusses.

**Engineering-Improvements.**

**SALES AND CASH REGISTER.**—CARL J. D. WALTER and JOHN RODGERS, Manhattan, New York city. The register is especially designed to be used in stores,

and is arranged to enable a salesman to record a sale and the amount of cash received and placed in the till. The record is made upon a paper strip wound from one reel to another, and is reproduced upon an underlying strip wound off from an auxiliary set of reels. A full record of the sales is made so that the owner of the store can ascertain the day's sales; and the total amount stated on the paper must correspond with the amount in the cash drawer. A device is provided to prevent the unauthorized opening of the till.

**LEMON-SQUEEZER.**—JOHN L. EASLEY, Manhattan, New York city. The squeezer is of the class in which a juice-extracting cone is employed and a receptacle for the juice. One object of the invention is to assure a more thorough separation of the seed and pulp from the juice than has been heretofore possible with such squeezers, and another object is to so construct the squeezer that it can be held in the hand while in use or placed upon a support if it be so desired.

**GARMENT.**—LAURA H. JOHNSON, Battle Creek, Mich. The invention provides a bust-support entirely free from stiffening devices, such as bones or steels, leaving the body of the wearer free from the constriction usually produced by belts or bands surrounding the body.

**LID FOR COOKING UTENSILS.**—JAMES H. SWIFT, Punta Gorda, Fla. The lid is swinging and detachable, especially applicable to saucepans, pots, and kettles, and so made that it can be horizontally swung upon a pivot serving as a handle, and that it can be lifted entirely from the body of the receptacles. The lid can be entirely removed from the vessel, and the pivot of the lid can be placed at either side of the vessel, enabling the lid to be swung to the right or to the left.

**COAL OR FREIGHT RUN.**—JOHN BRADY, Manhattan, New York city. The runway comprises an upper track and a lower track. A scale-platform, forming a portion of one of the tracks, is balanced to be upset by a given weight. A locking device is arranged to hold the scale-platform when desired in a fixed position. Elevator-cars travel in shafts extending from the upper to the lower tracks, each car being provided with rails capable of constituting sections of the lower track and with tracks at its sides at an elevation from the bottom. A receiver for weights is connected with the scale-platform, whereby the number of pounds placed on the platform in excess of the amount which the platform is designed to balance can be ascertained.

**METHOD OF PRODUCING ORNAMENTAL FABRICS.**—MARK H. FRANK, Manhattan, New York city. This invention is an improvement in methods for producing ornamented fabrics by placing embroidery and lacework thereon. The pattern for both the embroidery and lacework is stamped directly upon the base or body fabric. The lacework is then formed in the usual manner upon the surface of the fabric, whereupon the embroidery is directly worked so as to include the lacework and that portion of the base or body fabric within the lines of the embroidery-pattern.

**RATCHET SCREW-DRIVER.**—GEORGE E. GAY, Augusta, Me. Two pawl-members are loosely mounted on the blade and spring-pressed toward the ratchet-disk. A ferrule forms part of the handle and surrounds the disk and pawl-members. The ferrule has a longitudinal slot; and each pawl-member has an arm extending

through the slot. A ring, frictionally held on the ferrule, is adapted to engage with either arm, the ring being in width less than the distance between the two arms in their locked position, whereby the device may be used as an ordinary screw-driver.

**WIRE-HANGER.**—JAMES W. L. JAMES, Salt Lake City, Utah. The object of the invention is to provide a hanger which can be applied to hold a wire firmly without bending and moved along the wire when desired. In a casing open at its top and ends clamping-blocks are movable in opposite directions to engage the wire. A wedge-block moves the clamping-blocks outwardly.

**CATTLE-STANCHION.**—ADOLF JOEST, Kankakee, Ill. This cattle-stanchion is ingeniously constructed so that all the cattle can be quickly released at one time in case of an emergency, as for example, in case of a fire. This result is accomplished without enabling unauthorized persons to make use of the device for malicious purposes.

**REFRIGERATOR.**—JOHN NASH, Dayton, Wash. The refrigerator has a vertically-extending series of upwardly-extending pockets designed to receive the drippings from the ice-chamber, each pocket having a downwardly-extending lip adapted to direct the overflow from one pocket to the pocket next below. By this system, the air in the refrigerator is cooled and at the same time freed of impurities.

**MOUTH-GUARD FOR BOTTLES.**—CHARLES H. BOGART, Brooklyn, New York city. By means of this invention, the mouths of milk-bottles can be protected from fracture and can be identified as the product of a certain manufacturer even in the dark. A yielding band surrounds the neck of the bottle and engages the top edge of the bottle. A rigid ring is embedded in the band at the top edge, which band is of a diameter intermediate between the inner and outer diameters of the bottle's mouth. The band serves the dual purpose of protecting the bottle and serving as a means of identification.

**DOOR-LATCH.**—FREDERICK E. RICHARDSON, Manchester, Iowa. The door-latch comprises an integral yoke or stirrup-shaped bar, the ends of which embrace the door edge and serve as handles for the sides of the door. A locking-tooth is carried on the outer or bottom portion of the stirrup. A pivot is provided for the bar at one side of the door near its edge. A spring is mounted on the pivot and engages the stirrup to keep the locking-tooth projected. A keeper on the door-jamb is adapted to engage the tooth on the bar. The strain brought upon the latch by pressure upon the door when it is locked will in all cases be substantially lengthwise and not crosswise of the latch, as in most constructions. In consequence the latch gains in strength.

**STORM-FRONT FOR BUGGIES.**—ARTHUR A. PRALL, Dayton, Iowa. The storm-front comprises a frame constructed for attachment to the dashboard and adapted to extend upward beyond the dashboard and constitute a front support for a storm-curtain. This frame is provided with an opening through which the reins are passed, and with a glass window which can be closed or opened.

**PIPE-CLEANER.**—OTTO SPAHR, New Brighton, Richmond, New York city. The cleaner is a fixture to the mouthpiece and is of such shape that while being a conductor for the smoke, it will present scraping or

cleaning edges so arranged that by turning the mouth-piece, any particles adhering to the stem will be removed. The device is of such length and shape that it will extend into the bowl without interfering materially with the communication between the bowl and the stem, enabling such communication to be kept open, and the heel in the bowl to be loosened at any time without removing the attachment from the stem.

**WATER-WHEEL.**—WILHO RONKAINEN, Manhattan, New York city. Each side of the wheel is made up of three concentric rings, suitably braced, and supported on the hub by four spokes. A movable boxing incloses the paddles for about one-fourth of the circumference of the wheel. This boxing is fitted with rollers, which can be made to press against the periphery of the wheel and to act as a brake. For suddenly stopping the wheel, a number of dogs are pivoted in lugs around the periphery of the boxing. The dogs engage with the teeth of a ring-shaped rack fastened around the outside edge of the blades. The boxing occupies a position at the bottom of the wheel, and the water rushing through it acts on the blades. When the wheel is stopped, the boxing is raised to the top.

**SASH-BALANCE.**—THOMAS M. SPINKS, Alamogordo, New Mexico. This invention does away with sash-weights and provides four separate sashes sliding in separate grooves. The two sashes which make up the ordinary top sash of a window are suspended at both ends by cords passing over small pulleys. The pair of sashes which make up the ordinary bottom sash are suspended in like manner. The pulleys from which these sashes are hung are fastened one at each end of two cords that pass over pulleys in the window-frame. By this arrangement both pairs of sashes are balanced, as well as both members of each pair, and when the window is open its widest, the sash only occupies one-fourth of the opening.

**Designs.**

**BUCKLE-FRAME.**—HENRY KNOELL, Brooklyn, New York city. The design consists of two rounded side-bars which are parallel and curve first slightly upward and then downward. They are broadened upward at one end and are connected on the upper side by a cross-piece pointed on top, with a slot at the apex, and flat across its bottom edge. They are connected on the lower side by a straight, flat, cross-piece parallel to the bottom edge of the upper one. The side-bars are joined at their other ends by a rounded cross-bar having two spaced downward projections in the center of each under side.

**MENU-COVER.**—MAX BECK and ROBERT O. ZIMMERMANN, Manhattan, New York city. The cover consists of a rectangular panel having a metallic-like surface, surrounding which is a narrow border having a stippled appearance. The panel being raised or in relief in relation to the border, and the edges of the panel being indented in wave-like form. Displayed within the panel are wavy lines, forming a rectangular figure, at the corners and centers of which rounded projections appear.

**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.