THE CASTING OF ART BRONZE.

Bronze is the oldest known of all metals. We see it appearing at the dawn of humanity and following civilization step by step in all the phases of its development. It is upon it that man, scarcely having got beyond the stone age, made his first experiments in metallurgy, and the numerous objects of bronze that have come down to us make known to us quite accurately the processes in use at these remote epochs.

During this long succession of ages, the only process of any importance discovered was that of casting statues in a single piece, and which dates back to the end of the seventh century before our era. The methods that we now employ are almost exactly those used by our ancestors, the inhabitants of the lacustrine cities.

The manufacture of art bronze is divided into two parts—moulding and casting.

Moulding is the more delicate part of the operation, and upon it depends principally the success and proper execution of the piece. We are acquainted with three kinds—moulding in clay, especially employed for large bells, moulding in dry sand, the most usual process, and finally, moulding in wax, the most perfect but most costly process.

Now, these three processes were already in use in prehistoric times, as we know from objects and tools found in making excavations.

The principal drawback to moulding in sand is that in a statue the floating drapery, hair, arms and legs form as it were so many corners in the sand that interfere with the removal of the object from the mould. In most cases, therefore, it becomes necessary to divide the object of art into sections, to mould the different parts separately and afterward to unite them. This business is intrusted to the trimmers, chasers and bronze mounters. But the intervention of these different trades has the effect of injuring the artistic value of the work, since scraping produces differences in the color that can be got rid of only by the aid of a bronzing of varying thickness with glaring reflections which completely modify the value of the half tints reserved by the artist. Moreover, the chaser, often too zealous, emphasizes with his graver certain parts that the statuary had purposely left somewhat vague for the sake of concentrating attention upon the principal points of his work.

It is for this reason that wax, despite its high price, is infinitely preferable, it permitting of obtaining a casting in a single piece almost without joints.

At the epoch of the Renaissance, as in antiquity, the artist did not consider it beneath him to do the material part of the work himself. He gave the general outline by means of a clay core provided with strong bracings. This core was covered with quite a thick layer of wax in which the artist modeled the details. This wax was afterward covered with numerous coats of slip, at first very dilute and then thicker and thicker, so as to inclose the wax in a sort of gangue, both fine grained and resistant.

This done, a moderate heat sufficed to melt the wax, which, upon flowing away, left empty the space that the bronze was to occupy. After removal from the mould, one had in bronze a faithful reproduction of the work that the artist had modeled in wax.

Unfortunately, it too often happened that for various causes the bronze did not completely fill the space reserved for it, and the statue was then lost or at least much damaged. In admitting, even, complete success, there could be but one specimen of the work, without the possibility of obtaining an absolutely identical reproduction of it.

The needs of modern industry could not accommodate themselves to long and costly processes such as this, and it became necessary at any cost to substitute the workman for the artist in order to expedite matters and do the work more cheaply, although not so well. So the idea occurred to employ partial moulds for the production of small sheets of wax, which, afterward applied to a clay core and fastened together, gave, for a large number of specimens, the wax image to be reproduced in bronze. But this discovery, which was doubtless very interesting, was nevertheless inadequate to give absolutely satisfactory results. It was left to M. Le Bourg, a French statuary, to devise, in the same order of ideas, a process that was infinitely superior, from the standpoint of the results obtained, as well as from that of saving in manual labor.

Fig. 1.—MOULDING OF A WAX STATUETTE BY THE LE BOURG PROCESS.

Fig. 2.—HALF MOULD, SHOWING THE DIFFERENT ELEMENTS.

A. Plaster Shell. B. Gelatine Mould. C. Layer of Wax. D. Clay Core.

This process, briefly described, is as follows: The fact is well known that gelatine, although hard and dry when in contact with the air, softens and swells up when immersed in water, and becomes hard again upon losing its humidity. But if instead of water we employ glycerine and glucose, the elasticity will be preserved for a long time. By means of this soft gelatine, M. Le Bourg, instead of moulding the elements of a statue, moulds the latter in its entirety, surrounding it with a gelatine envelope in two pieces which is detached with the greatest ease and gives moulds of extraordinary fineness. Consequently, instead of an assemblage of elements, he obtains wax in a single piece. This done, he, by the ordinary processes of moulding in wax, covers the statue to be reproduced with slip, melts the wax and casts the metal.

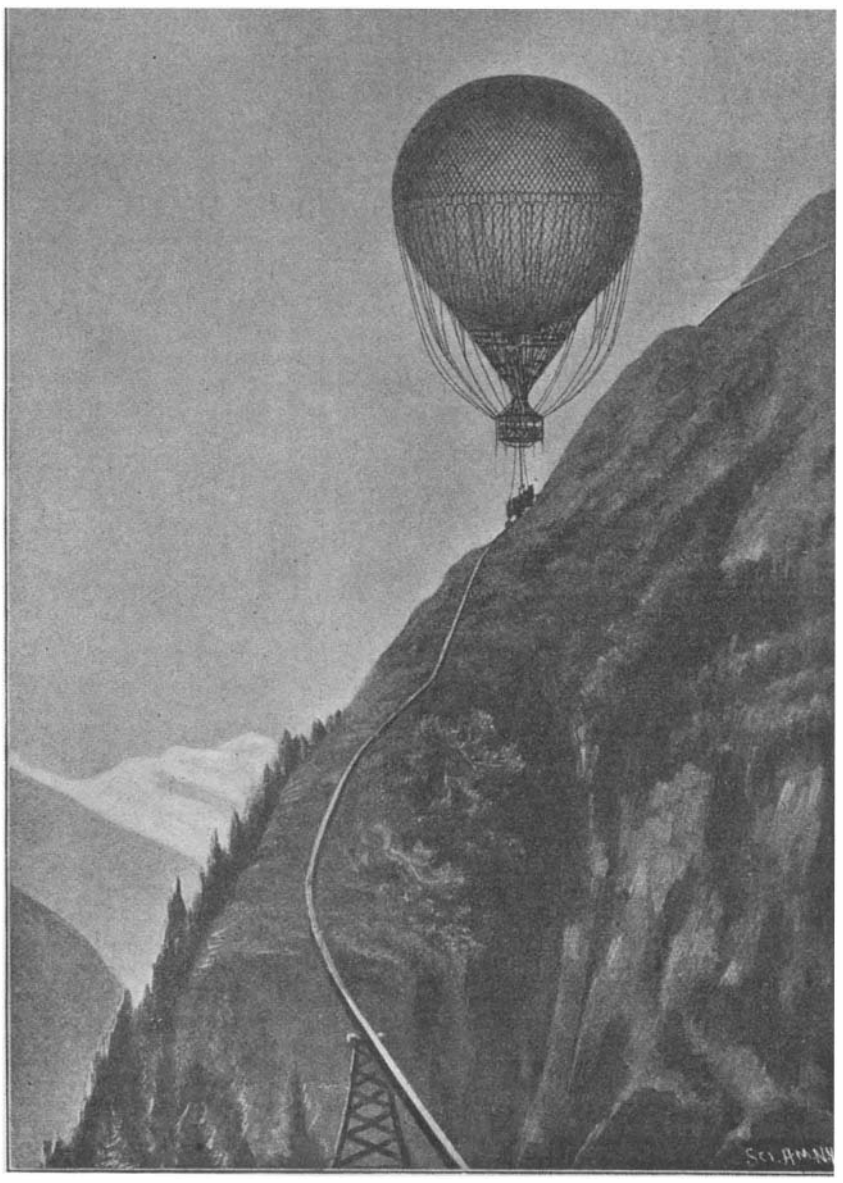
In order to manufacture the gelatine moulds, one begins by taking two moulds in plaster and working upon these so as thus to leave the original absolutely intact. One of the two moulds is scraped down superficially to a proper thickness so as to form a core that serves for obtaining a "core box" absolutely like those used in sand moulding. The second cast in plaster serves for making the mould. To this effect, one begins by covering it with a thick layer of clay, which entirely envelops it. Then there is cast over it a plaster shell, A, in two pieces. One of the halves of this having been taken off, the clay is carefully removed, so that half of the statue is thus exposed. It may be easily seen that if at this moment the half shell be put in place, there will remain between the latter and the statue an empty space, B, corresponding to that occupied by the clay just removed. This space is then filled by running in soft gelatine, which, owing to its extreme elasticity, may, at the proper moment, be taken out without ruining the model. (Fig. 2.)

Proceeding with the second half of the shell as with the first, there is obtained a gelatine impression of the second half of the statue. If, at this moment, the shell in two pieces, lined internally with gelatine, be put together, it will be seen that an exact and hollow impression of the statue to be reproduced will remain in the middle of the mould.

Let us now take a core, D, made in advance and properly dried and introduce it into the cavity in the middle of the mould. This it will occupy almost entirely and leave merely an annular space, C, that corresponds to the thickness to be given the metal. It is into this space that the melted wax is run, after which all that is to be done is to carefully remove the half shells in plaster and then the gelatine coverings in order to expose a statue that will be identical with that which an artist would have been able to model. (Fig. 1.) As may be seen, the Le Bourg process differs from the wax one only in the method employed for obtaining the wax cast, but with the advantage that the old process permitted of making but one casting, while now it is easy to have a large number absolutely identical and as delicate as those obtained by the classical wax process.

It is to be remarked that of all the operations that we have just described, none requires professional skill. Therefore, no more moulders, chasers, or mounters; and it is precisely one of the original features of the process that a bronze statue may be made without the intervention of any of the trades hitherto employed. The result is, besides, that the casts obtained have the rare merit of being an exact reproduction of the work of the statuary, whose artistic feeling is faithfully respected at every point.

We are indebted to La Nature for the engravings and particulars.



A SINGLE RAIL MOUNTAIN RAILWAY.

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A mountain railway built on quite a novel plan was tested last year on a small scale, and is to be shortly opened in a different locality for regular service. The principal feature of the new system is that the force of traction is directed vertically upward, and is derived from a balloon. A single rail is used for the only purpose of directing the course of the train and keeping the balloon with its load captive. To this end the rail is made T-shaped, and the car runs on it, gripping it from the sides and from below. The rail is anchored to the ground at distances of about 15 feet. In the

descent the propelling force is gravity, and the balloon acts as a check to prevent accelerated motion. A ballast of water, taken up at the top of the mountain, provides the additional downward force required. The truck carries the water receptacle, which can be opened by the aeronauts during the journey. The truck and receptacle together weigh about 660 pounds, and when there is no wind the receptacle carries about 1,100 pounds of water, making a total weight of 1,760 pounds. When it is windy the strain between the balloon and the truck is diminished by letting the water out of the receptacle, thus compensating for the difference in power. The difference in weight caused by passengers entering or leaving the car is regulated by the use of separate weights, a sufficient number of which will be kept at each station.

The tests made of this system were very favorable, and the inventors, Messrs. Volderauer and Brackebusch, are preparing to build a similar line to run up the Hochstauffen, near Bad Reichenhall, Bavaria. The inventors purpose making a balloon with a diameter of 65 feet 7 inches and a lifting power of 10,560 pounds. The balloon, car, net, rope, etc., weigh 4,620 pounds, and an allowance of 3,300 pounds is made for passengers and aeronauts, leaving a margin of 2,640 pounds.

There is a storage house where the balloon may be left in case of storm, and all possible measures are observed to insure the absolute safety of the passengers. The whole device seems very appropriate for the purpose it is to fulfill, and there seems no reason why the enterprise should not prove entirely successful.

We are indebted to the Illustrirte Zeitung for the cuts and description.

Mosquitoes.

Our readers, says Science Gossip, probably noticed the great prevalence of mosquitoes last summer, but familiar though they may be with the methods of its attack, few have any idea of the complicated apparatus with which this fly works its mischief. The beak of the mosquito is simply a tool box wherein the mosquito keeps six miniature surgical instruments in perfect working order. Two of these instruments are exact counterparts of the surgeon's lance. One is a spear with a double barbed head, the fourth is a needle of exquisite fineness, a saw and a pump going to make up the complement. The spear is the largest of the six tools, and is used for making the initial puncture; next the lances or knives are brought into play to cause the blood to flow more freely. In case this last operation fails of having the desired effect, the saw and the needle are carefully and feelingly inserted in a lateral direction in the victim's flesh. The pump, the most delicate of all six of the instruments, is used in transferring the blood to the insect's stomach.

Diphenal—a New Developer.

To the current number of the Photographische Correspondenz Dr. Julius Precht, of Heidelberg, contributes a note on this subject, an abstract of which may be interesting to our readers.

Diphenal is diamido-oxydiphenol, and is prepared from the acid extract of oxyazobenzole, and has been patented as a photographic developer by Leopold Casella & Company, of Frankfort, by whom it is placed on the market in the form of an alkaline solution, the salt itself forming white, needlelike crystals,, the solution being a dark brown color, which on dilution with water forms a nearly colorless solution, which does not stain the films nor the fingers, unless the latter are kept in the same for a very long time. It is stated to have all the conveniences of rodinal, with the advantages of pyro and iron. It gives extremely clear shadows, works very cleanly and free from fog, and gives all the delicacy and gradation of pyro. It surpasses all other developers in the latitude of exposure it allows, and with very great over-exposure there is no trouble. What it is necessary to do is to develop till the high lights are dense enough, and the shadows keep beautifully clear, more so than with any other developer except glycin.

It is specially suitable for objects with great contrasts, as it does not block up the high lights, and amateurs who are by no means certain of their exposures will find it exceedingly useful, as it so rarely gives fog. It is not a very rapid developer, the half tones and shadows succeeding the high lights in a regular manner, and not coming up simultaneously like metol, amidol and rodinal.

The stock solution is, for ordinary work, diluted with 15 parts of water for normal and over-exposure, while for under-exposure it may be used with only 8 or 10 parts of water. The brown color of the solution is not a sign of oxidation, as the stock solution has been kept for five months unchanged, and the diluted solution also keeps well. By repeated use the negatives do not, as with hydroquinone, become harder. With normal exposure and concentration the image appears in about twenty seconds, and development is complete in from five to ten minutes. With under-exposed plates, and a strength of 1:8, development may be continued for half an hour without harm. When it is known that correct exposure has been given, the developer may be used 1:10, and the image appears very quickly and development will be quite complete in about three minutes.

It is necessary to well wash the plates after development, in order to free them from the developer. If some of the ordinary fixing bath is mixed with a small quantity of the developer, the solution turns brown by the absorption of oxygen and a liquid is obtained which dissolves silver, and therefore can be used as a reducer. The brown solution thus formed also stains the gelatine. Diamido-oxyphenol can also be used without alkali as a developer—a property which is common to other para-amidophenols.—British Journal of Photography.

Firing Dynamite by Electricity.

At the Verbelia, Colorado, tunnel the dynamo used is located in the gulch twenty-five feet from the mouth of the tunnel; wires are run into the tunnel connecting with the electric caps, which, when the current is turned on, explode the dynamite. This electric cap, in construction, resembles an incandescent lamp, inasmuch as it has two wires leading into it with a filament of platinum, but it differs from the incandescent lamp filament in action. The filament in the lamp is strong enough to carry the current which makes it incandescent, and therefore gives out a steady light; but the filament in the cap is not strong enough to carry the current, but burns off, causing an electric spark to ignite the fulminating powder in the bottom of the cap and explode, thus exploding the dynamite. The wire and filament in the cap are held in place by sulphur, which is poured in while it is hot, thus making the cap waterproof. The dynamo, which connects by wires with a round of holes in the tunnel, has a pull-up or push-down handle, which is connected to the armature by means of cog wheels, which causes it to revolve at a high rate of speed, thus generating a large quantity of current, which is held in the dynamo by means of a short circuit until the armature has gained its highest speed, when the short circuit is automatically broken, allowing the current to flow through the caps and causing them to explode.

This is a safe way of exploding dynamite, says The Mining and Scientific Press, because the miner must get out of his shaft or tunnel before the current can be turned on, and, consequently, there is no danger of any of the shots going off prematurely or of any of them hanging fire; and, to be doubly safe, the miner can keep his dynamo locked and the key in his pocket.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR SIGNAL.—Caroline E. Miller, Minneapolis, Minn. This invention relates especially to signaling devices for street railway cars, and provides a manually adjustable device to indicate from a car the approach of another car on a parallel track, and be plainly visible to one about to cross the track, thus warning persons of possible danger from the approach of a car that is concealed from view. The device consists of a series of foldable blades, each blade carrying an electric light, and circuit wires flexibly connecting all the lamps to a source of electricity, the blades also being painted so as to be conspicuous in daylight, and the arrangement being such that the blades may be conveniently thrown to open position or set to normal folded position.

SWITCH ACTUATING MECHANISM.—Albert D. Hill, Audubon and Tchoupitoulas Street, and John Pohlig, 3809 Tchoupitoulas Street, New Orleans, La. This invention provides for operating the switch tongues by an adjustable shifting lever carried by an engine or car, the switch tongues being pivotally connected and levers extending therefrom carrying a tappet at their connecting point adapted to operate swinging dogs. The device is of simple construction, and is designed to be readily operated when a train is going at full speed.

Bicycles, Etc.

BICYCLE CRANK MECHANISM.—Henry I. Schanck, Holmdel, N. J. According to this invention a sprocket wheel is mounted eccentrically to the axle and has oppositely projecting parts, an arm being fixed to the axle adjacent to the sprocket wheel and having a hub running around the axle, while a second arm is held loosely to the axle alongside of the hub, projecting parts of the sprocket having sliding and pivotal connection with the arms. The improvement is designed to afford means for increasing leverage in applying power through the crank arms to the driving sprocket wheel during part of its revolution, giving proportionate increase of power for the propulsion of the bicycle.

BICYCLE DRIVING GEAR.—James E. Martin, Nicholson, North Dakota. The crank shaft, according to this invention, has toothed wheels with lugs on their side faces, the pedal levers having dogs engaging the teeth of the wheel, while gearing between the levers causes the movement of one crank in one direction and the other crank in the opposite direction, dogs pivoted to the levers engaging the lugs of the toothed wheels, and rollers on a guide frame releasing the dogs from the lugs. The gear is light and strong and may be applied to bicycles of the ordinary type without requiring material change in their construction.

Mechanical.

MITER BOX.—Thomas M. Griffith, West New Brighton, N. Y. For accurately guiding a saw in the formation of mating tongues and notches in the ends of box stuff, etc., so that accurately fitting dovetail connections may be readily made, this inventor provides a miter box of inverted U-shape in cross section, and having guide kerfs extending through the top and down into the sides of the box, the kerfs being similarly inclined in parallel planes and evenly spaced apart, there being also a longitudinally adjustable gage block on the under surface of the top at one end.

OIL CUP.—Wallace E. Tillinghast, East Greenwich, R. I. This invention provides an improved vent or auxiliary valve especially applicable for oil cups for use on crank pins and other rapidly moving parts of machinery, and designed to insure a steady flow of oil, without danger of forming a vacuum to retard the flow. On the upper head of the oil cup is an improved vent or air valve adapted to open automatically and positively in an inward direction, and the casing is formed with a flared or bell-shaped mouth, which acts as a funnel on the upstroke to concentrate the air at the opening in the valve seat, thus giving to the valve the positive properties of a pump.

Agricultural.

MACHINE FOR TOPPING SORGHUM.—Truman M. Paddock, Percival, Iowa. This is a device for attachment to a wagon bed, when, as the wagon is drawn between rows of sorghum, the tops of the sorghum will be directed over the wagon and cut off. A main guide arm is curved outwardly and forwardly away from the wagon body, and guides the sorghum between itself and a shorter spring arm at the rear of which is a knife, the attendant in the wagon holding the sorghum tops and drawing them with one hand against the knife, using the other hand to lay the tops straight in the wagon.

POULTRY COOP.—Charles W. Bumpass and William M. McCandlish, Bumpass, Va. For shipping chickens, turkeys, ducks, etc., these inventors have devised a novel form of coop of skeleton frame construction, covered with wire netting, the bottom being of basket work and readily removable. In connection with the removable bottom the base frame forms an important feature, as it furnishes a comparatively rigid support for the body of the coop, and facilitates taking out and putting in the bottom.

FRUIT GATHERING LADDER AND CHUTE.—George K. Davis, Lewiston, Me. This invention provides a wheeled ladder and attached chute which may be readily changed in position to gather fruit on all sides of a tree, the chute conveying the fruit down into a suitable receptacle. The props and tongues are detachable from the axle and standards of the wheeled vehicle, and the latter may be conveniently moved from place to place, the ladder bars being used as handles of a cart in pushing the device along. The chute is so made as to protect the fruit from being bruised in sliding down.

CHURN.—John Bennett, Lyndhurst, Canada. This churn has a reciprocal dasher serving to create a current of cream around a reservoir which may contain hot or cold water to regulate the temperature of the cream. The churn has within its body portion a hollow partition to be filled with a liquid of the desired temperature, and by the operation of the dasher the cream is agitated against the dasher, the cream circulating through passages provided at the top and bottom of the partition and up and down its sides.

Miscellaneous.

EXTENSION LADDER.—Charles H. Waterman, Dayton, Washington. This ladder is mounted on a truck and operated by winding and adjusting devices also carried on the truck, the apparatus being normally kept in folded position. An endless flexible connection on the truck is attached to the ladder, the latter being pivotally connected by a link with the truck, the ladder also having a flexible connection for extending it, and there being two gearings for driving the flexible connections, a driveshaft and a clutch alternately throwing the two gearings in and out of connection with the driveshaft. The ladder is particularly adapted for use at fires, and may be provided with a water hose wound on a drum.

VEHICLE TIRE.—Angus McI. Williamson, Philadelphia, Pa. On the felly of a vehicle wheel, according to this invention, is a recessed flanged band forming a channel for the reception of the inner part of a tire, of rubber or other resilient material, this portion of the tire being united to the felly by an interior rod or bar, whose ends are secured to the felly by a loop bolt. There is a leather strip covering the rod or bar, and outside of that an air space, to insure easy riding of the vehicle, while on the tread of the tire are integral spaced projections, making the action of the wheel steplike as it travels over the ground.

ROLLER ATTACHMENT FOR SLEIGHS.—James C. Perkins, Inwood, Iowa. At each side of the sleigh are pivoted roller carrying and lifting arms, the roller-carrying arms when in vertical position supporting the sleigh upon the roller, with the runners off the ground. The arms are held forwardly inclined above the ground when drawing the sleigh over snow, but when bare ground, a bridge, etc., are to be passed over, the arms are released, when a shoe on the end of each lifting arm engages the ground to lift the sleigh upon the roller, the roller arms then assuming a vertical position and the lifting arms swinging back. By backing the sleigh, the parts are again returned to the original position, with the runners on the ground.

OIL GAS APPARATUS.—Joseph H. Baker, Brooklyn, N. Y. This invention provides a device whereby oil and steam will be perfectly mingled and atomized in an atomizer within a retort to produce a speedy and economic conversion of them into an illuminating gas. A cylindrical casing adapted to be introduced into a retort is closed at one end, and near this end is an oil inlet, while near the open end is a steam inlet, there being a distributing nozzle secured to and projecting from the open end of the casing, while a curved atomizing nozzle is secured in the steam inlet and projects into the distributing nozzle.

CARPET STRETCHER.—Joseph E. Drake, Blue Rapids, Kansas. This device affords better means for grasping the carpet to pull on it than the use of points, as in most carpet stretchers, and also affords means for temporarily holding the carpet after the slack has been taken up and until the edge can be nailed down. The body portion of the device has hinged on its front edge a clamping bar adapted to be brought into engagement with a folded portion of the carpet for the full width of the clamp, whereby the strain is evenly distributed over the entire width of the stretcher.

RAISIN SEEDER.—Cary S. Cox, Fresno, Cal. To facilitate the rapid and cleanly removal of all seeds from raisins, without danger of cracking the seeds or tearing the fruit, this machine is made with a seeding cylinder from whose periphery extend teeth, while a seed-receiving cylinder revolves in the direction of the seeding cylinder, the seed-receiving cylinder having a yielding separable surface in which are pockets for the reception of seed, the yielding surface being arranged to receive the rows of teeth on the seeding cylinder and retain the seed forced from the raisins by the teeth.

DISAPPEARING STORM HOUSE.—Richard T. Bond, Atoka, Indian Ter. As a refuge in sections of the country where hurricanes and cyclones are not unknown, causing occasionally considerable loss of life, this inventor has devised a retreat consisting essentially of a sunken pit in which is a vertical mast or post extending a little above the surface of the ground, while a cage or similar structure is adapted to slide down in the pit, the floor of the cage having a hole to receive the mast, and there being a hoisting apparatus comprising a cable guide attached to the top of the mast and winding apparatus attached to the floor of the cage. This storm house should be placed near the main house or residence, and may be made ornamental for use as a summer house. etc.

PAPER WEIGHT AND SPONGE CUP.—Ephraim Jaques, Geneseo, Ill. The body of this device may be of glass, celluloid or metal, and has a central cuplike portion, connected at the bottom with a channel leading to one side, the channel terminating in a rubber bulb, by pressing upon which water is forced up into the cup, the surplus water being withdrawn when the bulb is released from pressure.

TAG.—John G. Fisher, Hanover, Mass. This is a device especially adapted for attachment to the inside of overcoats, hats, capes and other garments, as well as upon bundles or packages, the body of the tag being preferably of metal, and the device including a fastening pin of simple form, but which will securely lock the tag in position.

Designs.

PENHOLDER SUPPORT.—Antoine H. Meloche, Whitney, Mich. This is a support adapted to be placed on a finger of the hand, to hold the pen in proper position for writing, so that the penholder need not be placed on a desk when not being used.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.