

How Goodyear Became a Rubber Inventor.

The ruinous failure of the earliest American rubber manufacturers, says a writer in the Boston Commercial Bulletin, arose from the fact that they began their costly operations in ignorance of the qualities of the material which they had to deal with. No one had discovered any process by which India rubber once dissolved could be restored to its original constituency, and the importance of this item was overlooked until many men had been ruined.

It was in the year 1820, the same writer continues, that a pair of India rubber shoes was seen for the first time in the United States. They were covered with gilding, and resembled in shape the shoes of a Chinaman. They were handed about in Boston only as a curiosity. Two or three years after, a ship from South America brought to Boston 500 pairs of shoes, thick, heavy, and ill-shaped, which sold so readily as to invite further importations. The business increased until the annual importation reached half a million pairs, and India rubber shoes had become an article of general use.

The manner in which these shoes were made by the natives of South America was frequently described in the newspapers, and seemed to present no difficulty. They were made much as farmers' wives made candles. The sap being collected from the trees, clay lasts were dipped into the liquid twenty or thirty times, each layer being smoked a little. The shoes were then hung up to harden for a few days; after which the clay was removed, and the shoes were stored for some months to harden them still more.

Nothing was more natural than to suppose that Yankees could do this as well as Indians, if not far better. The raw India rubber could then be bought in Boston for five cents a pound, and a pair of shoes made of it brought from \$3 to \$5. Surely here was a promising basis for a new branch of manufacture in New England. It happened, too, in 1830, that vast quantities of the raw gum reached the United States. It came covered with hides, in masses, of which no use could be made in America; and it remained unsold, or was sent to Europe.

Patent leather suggested the first American attempt to turn India rubber to account. Mr. E. M. Chaffee, foreman of a Boston patent leather factory, conceived the idea, in 1830, of spreading India rubber upon cloth, hoping to produce an article which should possess the good qualities of patent leather, with the additional one of being waterproof. In the deepest secrecy he experimented for several months. By dissolving a pound of India rubber in three quarts of spirits of tur-

pentine, and adding lampblack enough to give it the desired color, he produced a composition which he supposed would perfectly answer the purpose.

He invented a machine for spreading it, and made some specimens of cloth, which had every appearance of being a very useful article. The surface, after being dried in the sun, was firm and smooth; and Mr. Chaffee supposed, and his friends agreed with him, that he had made an invention of the utmost value. At this point he invited a few solid men of Roxbury, Mass., to look at his specimens and listen to his statements. He convinced them. The result of the conference was the Roxbury India Rubber Company, incorporated in February, 1833, with a capital of \$30,000.

The progress of this company was amazing. Within a year its capital was increased to \$240,000. Before another year had expired, this was increased to \$300,000; and in the year following, to \$400,000. The company manufactured the cloth invented by Mr. Chaffee, and many articles made of that cloth, such as coats, caps, wagon curtains and coverings. Shoes made without fiber were soon introduced. Nothing could be better than the appearance of these articles when they were new. They were in the highest favor, and were sold more rapidly than the company could manufacture them.

The astonishing prosperity of the Roxbury company had its natural effect in calling into existence similar establishments in other towns. Manufactories were started at Boston, Framingham, Salem, Lynn, Chelsea, Troy, and Staten Island with capitals ranging from \$100,000 to \$500,000; and all of them appeared to prosper. There was an India rubber mania in those years similar to that of petroleum in 1864. Not to invest in India rubber stock was regarded by some shrewd men as indicative of inferior business talents and general dullness of comprehension.

The exterior facts were certainly well calculated to lure even the most wary. Here was material worth only a few cents a pound, out of which shoes were quickly made, which brought \$2 a pair! It was a plain case. Besides, there were the India rubber companies, all working to their extreme capacity, and selling all they could make. Such were the conditions of the trade when Charles Goodyear visited the New York office of the Roxbury Rubber Company to suggest some improvements in inflating a life preserver manufactured by the company. To his surprise the agent took him into his confidence and explained that the prosperity of all the India rubber companies in the United States was only apparent; that they needed an ingenious inventor to save them all from ruin.

The Roxbury company had manufactured vast quantities of shoes and fabrics in the cool months of 1833 and 1834, which had readily been sold at high prices; but, during the following summer, the greater part of them had melted. Twenty thousand dollars' worth had been returned, reduced to the consistency of common gum, and emitting an odor so offensive that they had been obliged to bury it. New ingredients had been employed, new machinery applied, but still the articles would dissolve. In some cases, shoes had borne the heat of one summer and melted the next. The wagon covers became sticky in the sun and rigid in the cold.

The directors were at their wits' end; since it required two years to test a new process, and meanwhile they knew not whether the articles made by it were valuable or worthless. If they stopped manufacturing, that was certain ruin. If they went on, they might find the product of a whole winter dissolving on their hands. The capital of the company was already so far exhausted that, unless the true method were speedily discovered, it would be compelled to wind up its affairs.

The agent urged Mr. Goodyear not to waste time upon minor improvements, but to direct all his efforts to finding out the secret of successfully working the material itself. The company could not buy his improved inflator; but let them learn how to make an India rubber shoe that would stand the summer's heat, and there was scarcely any price which it would not gladly give for the secret.

The worst apprehensions of the directors of this company were realized. The public soon became tired of buying India rubber shoes that could only be saved during the summer by putting them into a refrigerator. In the third year of the mania, India rubber stock began to decline, and Roxbury itself finally fell to \$2.50. Before the close of 1836, all the companies had ceased to exist, their fall involving many hundreds of families in heavy loss. The clumsy, shapeless shoes from South America were the only ones which the people would buy. It was generally supposed that the secret of their resisting heat was that they were smoked with the leaves of a certain tree, peculiar to South America, and that nothing else in nature would answer the purpose.

The \$2,000,000 lost by these companies had one result which has proved to be worth many times that sum: it led Charles Goodyear to undertake the investigation of India rubber. That chance conversation with the agent of the Roxbury company fixed his destiny.

RECENTLY PATENTED INVENTIONS.**Engineering.**

WATER TUBE BOILER.—Frank Printz, New Orleans, La. This is an improvement in boilers having a steam drum supported on water legs which connect it with mud drums, and provides a duplicate construction and combination of pipe coils with valve attachments whereby a portion of the apparatus may be isolated, while its duplicate is left intact, to facilitate repairs, etc. The main portion of the generator proper is inclosed by a metal casing having a hinged top and sides to facilitate access thereto, and is preferably lined with asbestos and fire tile up to the height of the fire box.

Railway Appliances.

CAR COUPLING.—Andrew J. Clark, Madison Station, Miss. Upon the front of a coupling head at the forward end of a spring-pressed draw bar are hooks projecting from the top and bottom sides of draught hook bodies, there being a tripping dog above the coupling head block, and flexible connections between the hooks and tripping dog, and means for operating the connections from a car, the locomotive, or the ground. With this improvement the cars are coupled automatically as they come together, the coupling working equally well on a straight track or on curves, and whether the car tracks are of the same or different heights.

AIR BRAKE.—John M. Hurst, Salt Lake City, Utah. This invention provides for retaining the air in the brake cylinders while recharging the auxiliary reservoirs, and consists of a pressure-retaining valve, a pressure-retaining reservoir, a valve interposed between the triple valve and the retaining valve, and a retaining pipe connecting the train pipe with the interposed valve. Each car exhausts its own air, and the amount is shown by the gage on the engine, while the pressure in all the brake cylinders of the train is equalized and the air now lost in applying the brakes is saved.

CAR FENDER.—Alexander S. Williams, Long Island City, N. Y. This fender consists of rods or bars banded together to form a lazy tongue structure adapted to be collapsed or distended, rollers adapted to travel on the rails being located on the lower portion of the fender. These fenders are designed to be placed at each end of a car, and when the car is placed in a shed the fenders fold up in small compartments beneath the dashboard.

SWITCH MECHANISM.—Sumter B. Battery, New York City. This is an improvement on a formerly patented invention of the same inventor, and provides a mechanism more especially designed for use on street railroads, and enabling the operator in charge of the car to readily set the switch according to the direction in which the car should travel.

Electrical.

ELECTRIC MOTOR.—Addison E. Boggs, Allegheny, and Fremont J. Cleaver, Belthoover, Pa. This is a motor especially adapted for direct connection with the machine to be driven or with line shafts or car axles, or for use in connection with gearing or pulleys and belts, for diminishing or increasing the speed. A field magnet is secured to one side of a wheel and an armature is mounted on the axle, while a commutator wheel is mounted on the boss of the armature and has an insulated rim upon which are placed commutator bars, an insulated ring being secured to the pole pieces of the field magnet. Inwardly extending studs secured to the insulated ring carry brushes, and metallic rings secured to the face of the insulated ring are connected with the studs.

TROLLEY AND TROLLEY POLE.—Wilbur L. Pepper, Philadelphia, Pa. According to this improvement a vertical pole is employed which permits the car to run with equal facility in both directions, an automatic device permitting the pole to yield vertically, according to the varying distance between the wire and car. The trolley wheel is held with an even pressure against the wire, making good contact during all the oscillations of the car and changes in the wire, while the good connections prevent excessive sparking.

Mechanical.

BAND AND SCROLL SAW ATTACHMENT.—Herman D. Hinternesch, Baltimore, Md. This attachment comprises a transversely tilting or rocking table with longitudinally movable guide devices to tilt the table in opposite directions, there being also back rests for the rear end of the timber being sawed, and the back rest and table having recessed and interlapping portions permitting the timber to be moved past the saw. The attachment may be conveniently applied to an ordinary band or scroll saw, to facilitate sawing hand rails, moldings, etc., for circular or curved stairways, the apparatus being conveniently adjustable to saw to any given circle or curve, and any degree of pitch or rise.

COTTON GIN.—John B. Crowder, Tallulah, Ala. This inventor has devised an attachment to an ordinary gin for removing dust, dirt, chaff or other trash from cotton as it comes from the saw and for breaking up bunches, curls or condensed portions of the cotton. It consists of a narrow ribbed or flanged concave beneath the gin brush, with open places adjacent to the ribs to permit a downward air draught.

WATER MOTOR.—Mifflin W. Bailly, Pottstown, Pa. According to this invention, the outlet valve of a flume discharges the water into a vessel held on the upper end of an inclined hollow working lever forming a connection between the upper vessel and a second vessel on the lower end of the lever, both vessels having valves having connections with fixed points and adapted to open and close alternately. The motor is designed to utilize the water to the fullest advantage without any waste.

Miscellaneous.

BICYCLE COAT.—Ansel B. Falk, New York City. This invention provides a brace for the inside of the back of the coat, designed to prevent the wearer from stooping forward as much as bicycle riders often do, the brace being virtually an integral portion of the coat. It consists of a centrally located pad of elastic material with diverging straps emanating from the ends and top of the pad and attached to the garment at the side back portions and at the collar portion.

PRESCRIPTION FILE.—Albert M. Stanley, Springfield, Col. This improvement comprises a casing in which are reels to receive the filing tapes, a table being located adjacent to an opening in the casing and rollers journaled at the ends of the table, while a tape secured to the reels passes over the rollers and table. Any prescription filed may be brought to view and as conveniently read as though it were not upon file, and files stored away may be as conveniently read as those in the file casing.

WHEEL.—Chilion T. Pelton, Riverside, Cal. This wheel is more especially designed for reapers and mowers, preventing dust and sand from being carried upward to enter the journal boxes or clog up parts of the machine. It has a flat rim with flanges on each side, cover plates on each side of the rim having latches engaging the flanges, the latches having handles outside the cover plates. These cover plates may be fitted to any form of wheel.

THILL SUPPORT.—Charles A. Rott-house, Brandywine Hundred, Del. This device consists of a spring rod bent at its middle to form loops receiving bolts for attaching it to the under side of a thill, the remaining portions of the rod being bent to form two spring coils and bearing portions engaging a bolt of the clip on the axle. The device is designed to securely hold the shaft in raised position, while yielding when the shaft is to be swung down.

HEEL PLATE.—Percy J. Van Valkenburg, New York City. On the under side of the shoe, according to this improvement, are two eyelets, one with a closed and the other with an open eye, the eyelets having split shanks which are passed through the heel and clinched on the inner side, in connection with which is used a plate having two ears, each capable of completely removable connection with the eyelets. The plate may be applied where the wear is greatest, and may be readily reversed as it is worn down on one side.

GATE.—Franklin R. Winters, Tulsa, Indian Territory. This is primarily a farm gate, of the lifting and swinging variety, and may be conveniently opened and closed by one on foot or in a vehicle. A rock shaft has a double crank hinged to the gate, and a duplex rock arm on the shaft has a locking limb projected between the duplex limbs, while a bracket plate with triple notched flange is adapted to receive the locking limb in either of the notches of its flange. The working parts are strong, inexpensive, and not liable to derangement or need of frequent repair.

GATE.—James Simpson, Veedersburg, Ind. This is a gate which may be opened or closed from either side by drawing down on a latch cable or on a lever cable, and it may be opened toward or away from the person operating it. A rearwardly extending lever fulcrumed on the swing post has a sliding connection with the gate, there being a cable connected with the rear end of the lever, and a second cable also so connected but having a bearing at the opposite side of the lever, the cables thus exerting force in opposite directions on the lever.

INTERMITTENT ROTARY MOTION.—Georg F. Halakjar, Copenhagen, Denmark. A mechanism for producing intermittent abrupt movements or "jerks," such as may afford an effective display of figures for advertising purposes, etc., has been devised by this inventor. It comprises an arm mounted to swing and provided with projections, while a disk is mounted to rotate about an axis eccentric to the swinging arm, the disk having alternating notches and solid portions moving across the path of travel of the projections of the arm.

COW MILKING MACHINES.—Jerry E. Harvey and Joseph H. Hoover, Hubbard, Iowa. These inventors have devised an apparatus for maintaining and regulating vacuums in these machines, by which a practically uniform expansion and tension of the air may be maintained in the milk receiver and its connections during the entire milking operation, irrespective of the quantity of milk drawn into the receiver. The apparatus comprises means for automatically expanding the air exhaust chamber as the air tension varies with the inflow of milk, there being a tubular connection between the chamber and the receiver or teat cups.

WARDROBE.—Robert H. Rodgers, Nashua, N. H. This is a construction especially adapted to be stored under a bed in houses deficient in closet room, and has a shallow, box-like body, with rollers on the bottom and handles at the front, while a cover slides on its top, cleats in the under side of the cover fitting in grooves in the inner sides of the body.

PROTECTIVE PAPER FOR CHECKS, ETC.—Herman Remke, Newport, Ky. This invention provides for treating the paper after it has been written upon with certain solutions to change its ink-receiving qualities. Two solutions are successively applied, the first being composed of three parts of some essential oil, preferably oil of lavender, sixteen parts of tincture of saffron and twenty-one parts of alcohol, and the second being a concentrated alkaline solution, preferably sodium carbonate in water. The quality of the paper is thus permanently changed, so that it will not readily take ink and the writing is not destroyed or blurred. The solutions are applied with a felt pad or stamp.

STRETCHER AND AMMUNITION CARRIAGE.—Frederic Remington, New Rochelle, N. Y. A wheel is loosely mounted upon an axle, according to this improvement, and telescopic cushioned arms are pivoted on the axle at opposite sides of the wheel, each arm hav-

ing a socket and a locking device, the sockets receiving a stretcher or an ammunition frame. The device is very light and may be folded to occupy but small space.

WASHBOARD.—Lewis Peterson, Madrid, Iowa. A hydraulic attachment for a washboard is provided by this invention, adapted to throw a stream of water from the tub on the clothes being rubbed. The upper end of the board in use is supported by cylindric sections which form substantially a pump by which the water is lifted from the tub and discharged over the clothes as the operator exerts a downward pressure in rubbing the clothes.

FOOT BALL.—Alexander Nisbet, New York City. This ball is made with a concealed lace, preventing abrasion of the skin of the player and insuring a truer rebound of the ball, and the leather cover is practically in two pieces only, dispensing with the four connected seams usually found at the end of the ball. A valve is also provided of such character and so placed that the ball need not be unladen to inflate it.

TAG AND TAG DRIVER.—William L. Millar, Charleston, S. C. This is a device for use with bales and packages as an improvement upon ordinary metallic tags and drivers. The shank of the tag has marginal flanges with a roughened surface, there being an anchor in the shank, and the tag driver, by which the tag is forced into the bale, has a handle at one end, while its opposite end is widened, terminating in a point. The driver is easily detached from the tag and removed from the bale.

CONTINUOUS CHARCOAL KILN.—Erik J. Ljungberg, Falun, Sweden. This kiln has several compartments in which the wood is ignited, the combustion gases being conveyed from one compartment to the other. The connection of the compartments is effected through valves closed by a sheet of water or water seals, the rising or falling of the surface of the water connecting or disconnecting the compartments. The process of carbonization is regulated by raising or lowering the water surfaces, whereby the area for the passage of inflammable gases is controlled.

Designs.

EWER.—Robert L. Johnson, Hanley, England. The mouth of this ewer has a convoluted edge in which scroll figures intersect each other, and the base has also a convoluted appearance matching the margin of the mouth.

CHRISTMAS TREE ORNAMENT.—William E. Wagner, Gordon, Pa. Within a circular tufted frame, according to this design, is held a spherical figure with upper and lower projections, forming an ornament for suspension from Christmas trees, etc.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE HERSCHELS AND MODERN ASTRONOMY. By Agnes M. Clerke. New York: Macmillan & Company. 1895. Pp. 324. Portrait. Price \$1.25.

This work is a volume of the Century Science series, which is edited by Sir Henry E. Roscoe. It is interesting to note that there are in preparation the lives of Michael Faraday, Clerk Maxwell, Sir Charles Lyell, Humphry Davy, Pasteur, Charles Darwin and Herman von Helmholtz. There are already several works on Herschel, but the present work contains the results obtained from a study of the correspondence of Sir William Rowan Hamilton and Herschel, the author having been favored by the late Miss Herschel with the perusal of a considerable number of the manuscript letters of Sir John Herschel as well as Sir William's. There are chapters on the "King's Astronomer," the "Explorer of the Heavens," "Herschel's Special Investigations," "Influence of Herschel's Career," "Caroline Herschel," "Writings and Investigations."

BULLETIN OF THE UNITED STATES FISH COMMISSION. Vol. XIV, for 1894. Washington: Government Printing Office. 1895. Pp. 496. 8vo. 25 plates, illustrated.

This volume, like the preceding Bulletins, consists of monographs, and, as usual, contains some important papers, as for example the Salmon Fisheries of the Columbia River Basin, by the late Marshall MacDonald, United States Commissioner of Fish and Fisheries.

INSECT LIFE: DEVOTED TO THE ECONOMY AND LIFE HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE. Edited by L. O. Howard, Entomologist United States Department of Agriculture. Vol. VII, No. 5. Washington. 1895. 8vo pamphlet.

This journal is published by authority of the Secretary of Agriculture, and is deserving of more attention than it has received. The present number gives the results of some remarkable experiments and observations. The division of entomology of the Department of Agriculture consists of one entomologist, three assistant entomologists, four investigators, one artist and a special agent in apiculture.

UNIVERSITY CORRESPONDENCE COLLEGE. The Calendar 1894-1895. London, September 1, 1894. Pp. 69. 16mo.

REPORT ON THE TOTAL ECLIPSE OF THE SUN OBSERVED AT MINA BRONCES, CHILE, ON APRIL 16, 1893. By J. M. Schaeberle, Astronomer in the Lick Observatory. Sacramento. 1895. Pp. 126. 8vo. 10 plates.

This book is printed by the authority of the regents of the University of California and forms volume No. 4 of the contributions from the Lick Observatory. The expedition to observe the total eclipse of the sun of April 16, 1893, was sent from the Observatory at the cost of Mrs. Phebe Hearst, a friend of the University of Cali-

fornia. The book gives full details of the observations made by the astronomers.

ELECTRICITY FOR STUDENTS. By Edward Trevert. Lynn, Mass.: Bubier Publishing Company. 1895. Pp. 128. 16mo. 38 illustrations. Price \$1.

The object of this little book is to explain briefly the theory and practice of some of the commoner applications of electricity. It is intended only as a popular treatise dealing with the practical applications of the science.

PRINCIPLES AND PRACTICE OF AGRICULTURAL ANALYSIS. A manual for the estimation of soils, fertilizers, and agricultural products, for the use of analysts, teachers, and students of agricultural chemistry. Vol. II. Fertilizers. By Harvey W. Wiley. Easton, Pa.: Chemical Publishing Company. 1895. Pp. 332. 8vo. 17 illustrations. Price \$2.

A few weeks ago we reviewed Dr. Wiley's "Soils," the companion volume. The present work takes up the subject of fertilizers. Certainly no one could be more competent to deal with the analysis of fertilizers than the Chemist of the United States Department of Agriculture. In the present volume the general principles of fertilizer manufacture and application have been presented in so far as they seemed to throw light on the rational method of examination and analysis. The standard methods of analysis in this and other countries have been presented with sufficient fullness for the guidance of the skilled worker and the information of the student. To those who make use of a book only for routine work or for preparation for an examination, this volume will be found to have little attraction. This fact, however, will not be a cause of regret to the author, whose purpose has been avowedly to present to the busy worker and student a broad view of a great subject which each one does not have the time to search out for himself. The author's list of authorities cited is very full and the type and presswork are excellent.

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8. A Colonial residence at Mountain Station, N. J. Two perspective elevations and floor plans. Mr. H. C. Pelton, architect, New York City.
9. A house at New Haven, Conn., recently erected at a cost of \$3,500 complete. Two perspective elevations and floor plans. A modern economical cottage design. Architects, Messrs. Stilson & Brown, New Haven, Conn.
10. A Colonial cottage at Bronxville, N. Y., recently completed at a cost of \$4,600. Perspective elevation and floor plan. Mr. W. H. Rahman, architect, New York City.
11. Miscellaneous Contents: Buff brick.—Tower tanks for water works, illustrated.—An old Baltimore firm.—Compo-Board instead of plaster.—Translucent fabric, a substitute for glass.—Ventilation and heating of school buildings.—Ornamental glass.—A light and strong lifting jack, illustrated.—An improved circular saw, illustrated.—An improved wood working machine, illustrated.—Stamped steel ceilings, side walls and wainscoting, illustrated.—Spring hinges.—Mallory's standard shutter worker and fly screen.—An improved nail set, illustrated.

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

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Minerals sent for examination should be distinctly marked or labeled.

(6634) C. M., Bala, Can., asks for a receipt for tempering drills for granite rock. A. Drills for granite, for best effect, should have their cutting edge at an angle of 75°, and if single blade, should have the point a little on one side of the center. By this shape the side thrust of the drill gives it a clearance and prevents sticking. Careful and slow heating to as low a heat as will allow the particular brand of steel to harden is desirable. Harden in salt water; one quart of salt to a pail of water. Some smiths add a couple of ounces of yellow prussiate of potash to the pail of salt water. The principal aim should be to work the steel at a low heat, avoid burning the corners and not draw the temper.

(6635) J. M. R. asks: Will a bicycle run easier and cut the bearings less with oil on bearings, or without oil, or with plumbago on bearings instead of oil? A. The best lubricant for bicycles is cylinder or dynamo oil of the trade, mixed with 10 per cent of finely ground graphite for the bearings. This mixture should flow from the spout of the oil cup. For the chain, graphite should be made into a soft paste with the above oil. We do not recommend dry bearings or dry chain.

(6636) D. W. H. asks which side of rubber belting should be run next to the pulley—the face side or the lap side. A. The face side of a rubber belt should be next the pulley; it gives a more perfect contact and is less liable to slip and wear at the lap seam.

(6637) C. H. says: I wish to etch a design on a pair of skates. Will you please tell me the quickest and easiest way of doing it? A. For etching on cutlery a ground wax is required, composed of equal parts asphaltum, Burgundy pitch and beeswax, melted together and thoroughly incorporated. In applying it, use a dabber, or ball of cotton covered with silk. Warm the piece of cutlery so that a stick of the wax will readily melt by touching. Smear a small quantity of the wax on the blade or articles, and dab it evenly all over the surface. When cold, scratch the required design or name on the surface and touch the parts with acid (nitric acid 1 part, water 4 to 6 parts), using a camel's hair pencil to cover the surface and bring the acid into contact with all the lines. In a few minutes the biting is done. Dip in hot water to wash off the acid, and the surface may be cleaned by wiping with benzine. Another way is to make a varnish of asphalt and turpentine, with a few drops of linseed oil to make it tacky. Have a rubber stamp made of the required design, with a border, so as to stop off around the design. Stamp the goods, and with some of the varnish thinned down with turpentine and a brush stop off the surrounding parts; or surround the design with a small rim of beeswax, and apply the acid as above.

(6638) H. B. J. says: Will you kindly tell me what preparation is used in stiffening felt hats? A. Mix 18 pounds of shellac with 1½ pounds carbonate of potash and 5½ gallons of water. Put in a kettle and boil gradually until the shellac is dissolved, when the liquid will be as clear as water. When cold dip the hats, and when nearly dry dip in a weak solution of acetic or sulphuric acid, in order to neutralize the potash and cause the shellac to set.

(6639) R. J. asks: What two metals will slide the easiest, one upon the other? Say a bar one

inch wide to slide across another bar of the same width, the weight to be one hundred pounds. A. With dry surfaces the hardest metals with smooth or polished surfaces have the least sliding friction when two surfaces of the same kind of metal are rubbed together. Hardened steel surfaces have the least friction of the metals most convenient for general use. Antimony on hard steel has a low per cent. of friction, as has also nickel upon nickel or nickel upon hard steel.

(6640) G. R. R. asks: Will you inform me through your paper the year in which the first railroad sent out a train, and whether the B. & O. was absolutely the first? A. The first trial of a locomotive in the United States was in August, 1829, with the Stourbridge Lion, built in England for the Delaware & Hudson Canal Company. It was tried alone without cars, Horatio Allen being the engineer. It was set aside and never used again. Peter Cooper built the first locomotive that drew a train of passenger cars in the United States. It was built during the year 1829 and used with a train of two cars on August 28, 1830, on the B. & O. Railroad. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 371, for a History of Early American Railroads and Locomotives.

(6641) B. H. C. asks how to prepare sheepskins for mats. A. Make a strong lather with hot water and let it stand till cold; wash the skin in it, carefully squeezing out all the dirt from the wool; wash it in cold water till all the soap is taken out. Dissolve 1 lb. each of salt and alum in two galls. of hot water, and put the skin into a tub sufficient to cover it; let it soak for twelve hours, and hang it over a pole to drain. When well drained stretch it carefully on a board to dry, and stretch several times while drying. Before it is quite dry, sprinkle on the flesh side 1 oz. each of finely pulverized alum and saltpetre, rubbing it in well. Try if the wool be firm on the skin; if not, let it remain a day or two, then rub again with alum; fold the flesh sides together and hang in the shade for two or three days, turning them over each day till quite dry. Scrape the flesh side with a blunt knife and rub it with pumice or rottenstone.

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