AN INEXPENSIVE AIR PUMP.

BY GEO. M. HOPKINS.

A brass air pump gleaming with polished and lacquered surfaces, mounted on the conventional mahogany base, and furnished with accessories for convenient experimentation, is desirable and useful, beside being ornamental; but how many of those interested in the study of pneumatics have free access to such a machine, or, indeed, any other apparatus which will enable them to investigate practically and individually the interesting phenomena of the air and gases? It may be safely said that the number is comparatively small. The engraving illustrates an efficient air pump for both exhaustion and compression, which may be made from materials costing one dollar and fifty cents, and with the expenditure of not more than two or three hours' labor.

With this pump, the entire range of ordinary vacuum and plenum experiments may readily be performed by the aid of a few well known and inexpensive articles, such as lamp chimneys, fish globes, a tumbler or so, and pieces of sheet rubber, bladder, etc.

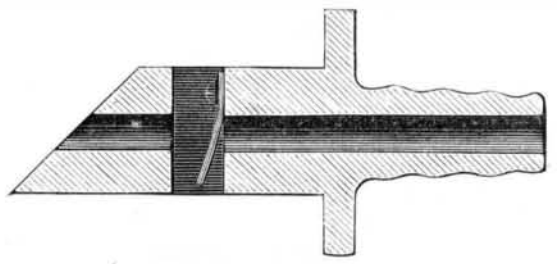
In the present article, only the pump will be described, the experiments and accessory apparatus being reserved for a future article.

Fig. 1 illustrates the manner of using the pump. Figs. 2 to 5 inclusive are sectional views of the pump and its valves. Fig. 6 shows a form of valve for the compression pump, and Fig. 7 shows the application of a foot pedal to the pump.

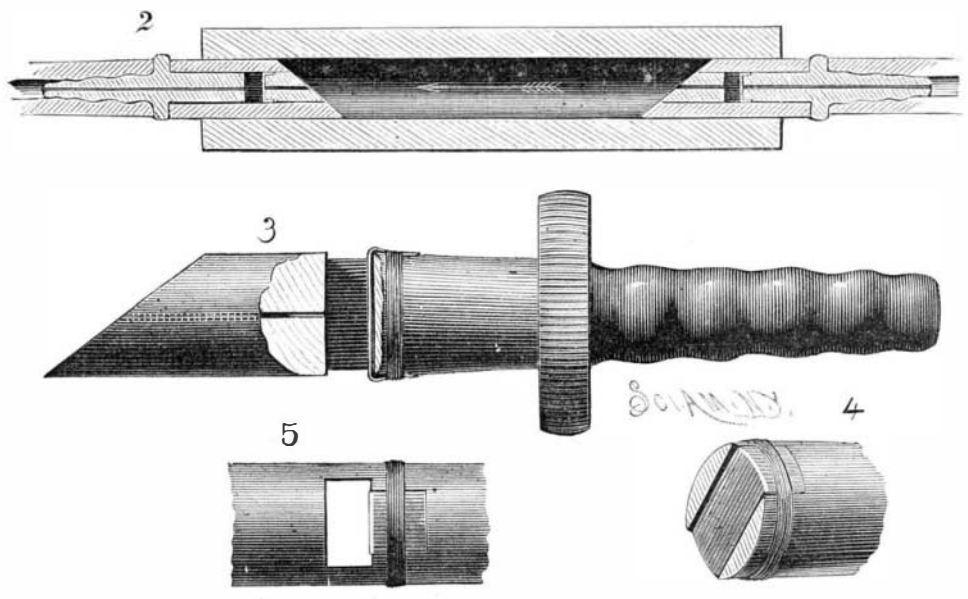
The materials required are as follows: A piece of so-called pure rubber tubing 1¾ inches external diameter, 1 inch internal diameter, and 9 inches long; a piece of pure rubber tubing 1 inch external diameter, ⅝ inch internal diameter, and 5 inches long; a piece of heavy pure rubber tubing ⅝ inch external diameter, and 4 feet long; two wooden valve casings (shown in Fig. 3); a strip of the best oiled silk, ⅜ inch wide and 8 or 10 inches long; and some stout thread.

The piece of 1 inch rubber tube is cut diagonally at an angle of about 30°, so as to divide it into two similar pieces. The wooden valve casing is pierced longitudinally with a one-sixteenth inch hole and transversely with a hole ½ inch square, and thoroughly shellacked or soaked in melted paraffine to render it impervious to air. The longitudinal hole is cleared out, and the walls of the square transverse hole are smoothed. One of the walls of the square hole into which the one-sixteenth hole enters forms one valve seat, and the other forms the other valve seat. The valves each consist of two thicknesses of the oiled silk strip stretched loosely over the valve seat, and secured by the thread wound around the wooden valve casing. It will of course be understood that when the valve casings are placed in the 1 inch rubber tubing, and the 1 inch tubes are placed in the ends of the larger tube, as shown in Fig. 2, the valves must both be capable of opening in the same direction, so that the air may pass through the pump as indicated by the arrow, entering by one valve and escaping by the other.

The pieces of rubber tube inclose the valve casings, so that each valve has a little air-tight chamber of its own to work in. The beveled ends of the rubber tube



6.—VALVE FOR COMPRESSION PUMP.



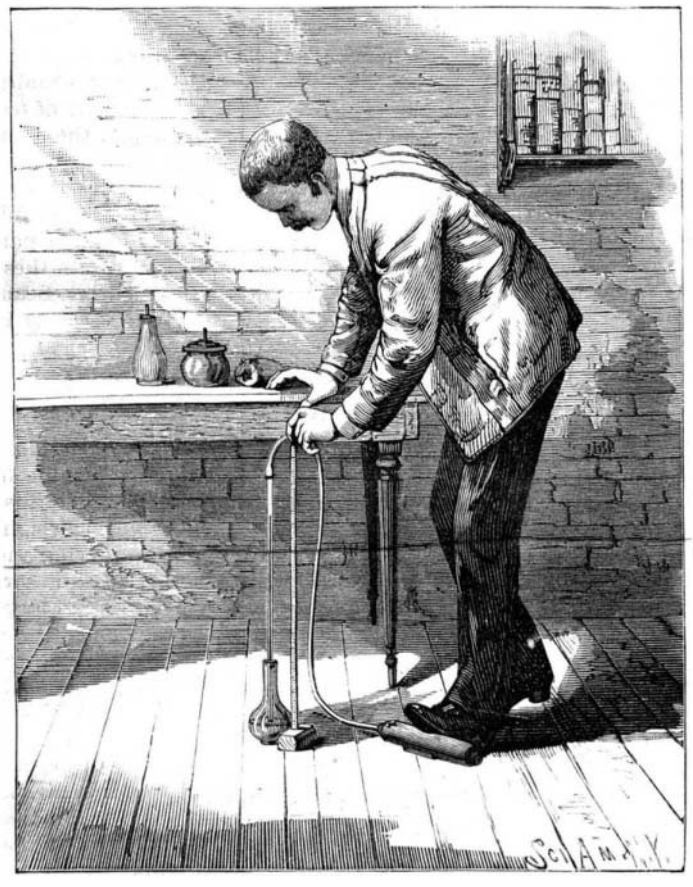
2.—LONGITUDINAL SECTION OF SIMPLE AIR PUMP. 3.—VALVE CASING PARTLY IN SECTION.
4.—TRANSVERSE SECTION SHOWING VALVE IN PERSPECTIVE. 5.—PLAN VIEW OF VALVE.

are arranged as shown in the engraving, and the inner ends of the wooden valve casings are beveled to correspond, so that when the large rubber tube is placed on the floor and pressed by the foot, there will be very little air space left in the pump. The four foot rubber tube is attached to one end of the pump for vacuum experiments, and to the opposite end for plenum experiments. To avoid any possibility of the sticking of the valves, the valve seats are rubbed over with a very soft lead pencil, thus imparting to them a slight coating of plumbago, to which the oiled silk will not adhere. As an elastic rubber pump barrel, of the kind described, requires considerable pressure of the foot to insure the successful operation of the pump, it is advisable to construct a treadle like that shown in Fig. 7 It consists of two short boards hinged together, the lower one having a shallow groove for the reception of the middle part of the pump. The edges of the upper board are beveled at about the same angle as the ends of 1¼ inch rubber tube. The width of the hinged boards should be somewhat less than the length of the chamber in the pump. A mark is made on the side of the larger tube at one end to indicate the top, the proper position for the pump being that shown in Fig. 2.

The pressure of the foot on the side of the pump barrel expels the air through the discharge valve, and when the barrel is released, its own elasticity causes it to expand, and while regaining its normal shape it draws the air from any vessel communicating with the suction valve.

A vacuum sufficient for most of the ordinary experimental work may be produced by means of this pump in a short time. A gauge may be improvised by attaching the suction pipe to a piece of barometer tube about 30 inches long, and dipping the end of the tube in mercury, using a yard measure as a scale, as shown in Fig. 1. The pump will be found to compare favorably with piston pumps.

When it is desired to construct a pump of this kind for compressing air or for a low vacuum, the elastic tube forming the pump barrel may be larger and thinner, and the hole through the wooden valve casing may be made larger, as shown in Fig. 6, and the oiled silk valve may be replaced by a simple rubber flap valve, held in place by a single tack.

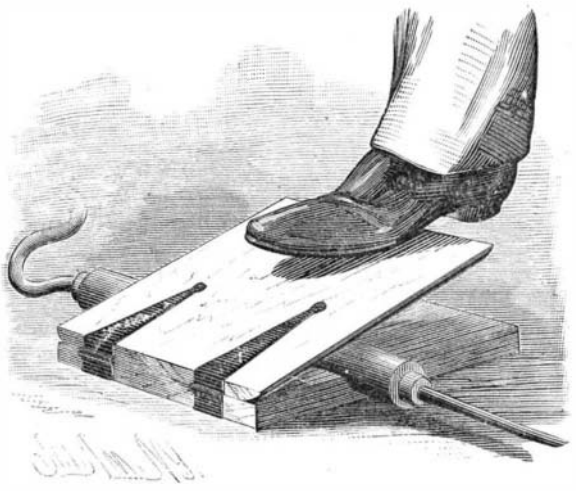


1.—TESTING SIMPLE AIR PUMP.

To dissolve old rubber so as to form a kind of rubber paint for cloth, use coal tar benzole.

Drying Up of Great Lakes.

The rapid drying up of lakes in the Aral-Caspian depression, in so far as it appears from surveys made during the last hundred years, is the subject of a very interesting and important paper contributed by M. Yadrintseff to the last issue of the *Izvestia* of the St. Petersburg Geographical Society. Two maps, which will be most welcome to physical geographers, accompany the paper. One of them represents the group of lakes Sumy, Abyshkan, Moloki, and Tchany, in the Governments of Tobolsk and Tomsk, according to a survey made in 1784. The other represents the same lakes according to three different surveys made during our century, in 1813 to 1820, in 1850 to 1860, and finally in 1880, and it shows thus the rapid progress of drying up of these lakes. There are also earlier maps of Lake Tchany, which represent it as having very many islands (Pallas estimated their number at seventy), but they are not reliable. As to the map of 1784, no cartographer, accustomed to distinguish "nature true" maps from fancy ones, would hesitate in recognizing it as quite reliable as to its general features. It is also fully confirmed by the ulterior detailed surveys dating from the beginning of our century. It appears from this series of four maps, dating from different periods, that the drying up has gone on at a speed which will surely appear astonishing to geographers. The groups of lakes consisted of three large lakes, Sumy, Abyshkan, and Tchany, with a smaller lake, Moloki, between the two latter. Lake Tchany (the largest of the three) has much diminished in size, especially in its eastern and southern parts, but the greatest changes have gone on in the other lakes. Whole villages have grown on the site formerly occupied by Lake Moloki, which had a length of twenty miles at the end of last century, and now is hardly three miles wide. Of Lake Abyshkan, which had a length of forty miles from north to south, and a width of seventeen miles, in the earlier years of this century, and whose surface was estimated at 530 square miles, only three small ponds have remained, the largest of them being hardly one mile and a half wide. The drying up has been going on with remarkable rapidity. Even twenty-five years ago there were several lakes ten and eight miles long and wide where there are now but little ponds. Lake Tchebakly, which was represented in 1784 as an oval forty miles long and thirty miles wide, has an elongated irregular shape on the map of the beginning of our century. It measures, however, still forty miles in length, and its width varies from seven to twenty miles; while several small lakes to the east of it show its former extension. Thirty years later we find in the same place but a few small lakes, the largest of which hardly has a length and width of three miles; and now three small ponds, the largest of them having a width of less than two miles, are all that remain of a lake which covered about 350 square miles a hundred years ago. The same process is going on throughout the lakes of West Siberia, and throughout the Aral-Caspian depression. No geologist doubted upon, but we cannot but heartily thank M. Yadrintseff for having published documents which permit us to estimate the rapidity of the process.—*P. K.*, *Nature.*



7.—TREADLE FOR AIR PUMP.

Bromidia.

In the decline of life, when exhausted nature habitually repels the restorative influence of sleep, there is nothing so suitable to induce healthful repose as one-half to one teaspoonful of bromidia, at bedtime. It may be taken for years, in the same dose, with the same effect and without detriment.—*Amer. Med. Jour.*

ENGINEERING INVENTIONS.

A boiler cleaner has been patented by Messrs. James Millar and George Feeny, of Amabel, Ont., Canada. It is a brush formed of steel wire mounted in a head hinged to a block, on one end of a manipulating bar or rod, which passes loosely through the block, and upon either side carries two arms or lugs, which project at right angles from the rod.

A steam plow has been patented by Mr. William Lay, of Omaha, Texas. A steam boiler and engine suitably mounted on a frame revolve a shaft on which are disks carrying several pairs of shovels, which are forced into the ground vertically and drawn out in an inclined position, loosening and raising the ground, and at the same time propelling the plow forward.

A safety attachment for locomotive tenders has been patented by Mr. Charles W. Dikeman, of Racine, Wis. It is intended to facilitate the escape of the engineer or fireman foreseeing a collision or other accident, and consists of an arm made to swing out some sixteen feet from the tender, bearing a man with it, upon the man standing upon a step which controls the swinging arm.

A car coupling has been patented by Mr. Albert M. Gregory, of Newton Factory, Ga. Combined with a drawhead, pin, and weighted pivoted block, is a cord secured to the upper portion of the stop block and extended thence rearwardly, whereby the block may be operated to release the pin, there being sufficient play to enable the proper coupling of drawheads of different heights.

A flue broom has been patented by Messrs. Peter Light and John Luscher, of Frankfort, Ky. It is an expansible broom, in which the broom sections are adjustably supported by radially slotted disks secured to the ends of a tubular shaft, with means for guiding the broom sections at the periphery of the disk, whereby a single broom may be adapted to flues of different sizes, or readily adjusted to compensate for wear.

AGRICULTURAL INVENTIONS.

A check row corn planter has been patented by Mr. John K. Voorhees, of Pella, Iowa. It has a combined pulverizing and marking wheel, with seed dropping mechanism, such that the seed will be dropped at the proper time to be in line with the marks made by indicating knives, and the arrangement being such that the depth to which the knives enter the ground can be readily regulated.

A hand corn planter has been patented by Messrs. William A. Esterly and Ebenezer W. Poe, of Bowling Green, Ohio. Combined with a stock, to one side of which is attached a seed box, is a seed dropping slide, which passes through openings in the stock, together with hinged side jaws and an operating mechanism, whereby the seed will be properly divided before being discharged into the ground.

MISCELLANEOUS INVENTIONS.

A lap robe holder for vehicles has been patented by Mr. Fitz Hugh Littlejohn, of Broadalbin, N. Y. It consists of a spring hook and spring clamp and flexible connection between them, the holders to be made of such length as to hold the lap robe with the necessary closeness to the body of the rider.

A buckle has been patented by Mr. Isaiah H. Osborn, of Wilmington, O. It is a rectangular frame with a back plate and a spur for receiving a strap, a spring arm being attached to the front for holding the strap on the spur, the buckle being more especially adapted for the hip strap of a harness.

A nut lock has been patented by Mr. Mannasseh W. Farber, of El Dorado, Kan. The bolt and nut are grooved, and there is a locking key to fit these registering grooves, the key being made of spring wire, bent at several angles, to adapt it to its functions, and one end bent laterally to form a claw.

A bolt has been patented by Mr. Joseph A. Coultaus, of Brooklyn, N. Y. It is made with a bevel faced feather, the bevel of which extends from the face of the bolt shank to the inner face of the head, the bolt being especially designed for mounting caster rollers within the forked arms of the body of the caster.

An automatic fire alarm has been patented by Mr. Thomas H. Prescott, of Sackville, N. B., Canada. It is a signal tripping device, in which the signal is tripped by a rise in temperature, and in which an easily pliable material is employed, by the partial fusing of which the signal tripping devices are released.

A movable threshold has been patented by Mr. Eugene Schmidt, of Stillwater, Minn. It is a construction arranged to be carried by and applicable for use in connection with any door, being designed to do away with permanently mounted thresholds, and leave the floor level beneath the lower edge of the door.

A nut lock has been patented by Mr. Isaac R. Ritter, of Reading, Pa. This invention consists principally in a novel combination of notched nuts, with a notched retaining plate and springs arranged to lock the nuts upon the bolts, the device being designed for use on railway joints and in other places.

A strap ear for well buckets has been patented by Mr. William H. Parrish, of Richmond, Va. It is composed of a single metal strap formed at its upper end with an eye having a hook-shaped lower end, and so made as to prevent the hoops of a bucket from coming off, while the shape of its lower end will prevent it from being pulled off of the bucket.

A thill coupling has been patented by Messrs. Percy J. Hindmarsh and William H. Gwinn, of Centralia, Kan. The coupling is arranged to be used in connection with a novel form of attachment designed to prevent the rattling of the shackle, bolt, and thill eye, to effect which a novel construction and combination of parts is provided.

An automatic candy shaping machine has been patented by Mr. Gustavus C. Snyder, of New York city. It consists of a sizing device, a series of interchangeable rollers, one having a rotary cutter, a device for automatically opening and closing the hopper and the series of rollers, and another for keeping the candy in motion until it has cooled off.

A lamp burner has been patented by Mr. Shipley W. Spooner, of Astoria, Ore. The invention covers a special construction of burner, match carrier, and igniter, the match carrying mechanism being readily removable to allow the parts to be cleaned, and the lighter being applicable to burners for any kind of oil, burning fluid, or gas.

A lamp chimney cleaner has been patented by Mr. William J. Webb, of Harbor au Bouche, Nova Scotia, Canada. It has a series of flat or plate springs, attached to work with a suitable handle, so that they may be expanded inside a cover of suitable fabric, the device being applicable for lamp chimneys of different sizes.

A lead-corroding pot has been patented by Mr. Peter H. Decker, of Ellenville, N. Y. It is made of glass, with its lower part of smaller internal diameter than the upper part, and with a shoulder upon the inside, so that the acid for corroding may be placed in the bottom of the pot, and the metallic lead placed in the pot to rest upon the shoulder, with other novel features.

An egg carrier has been patented by Mr. John Shibley, of New York city. This invention relates to egg carriers made with pockets or cells to hold the eggs, such as are usually made of pasteboard, and provides for constructing the carrier to permit the cells to yield to the weight of the eggs, while strengthening the carrier.

A sheet holder for marine vessels has been patented by Mr. Eben F. Enos, of Magnolia, Mass. It is a post with a foot or flange for attachment to the deck of a vessel, a shaft being journaled in the post with drum and ratchet, the ratchet being engaged by a pawl pivoted in the post, by means of which the sheet is held as it is hauled in the manipulation of the sails.

An anchor has been patented by Mr. Robert R. Spedden, of Astoria, Ore. It is made of separable parts, so that it can be readily taken to pieces for storage or shipment, the shaft having hooked pivots, so that no screw threading and nuts are required, and a triangular fluke is used, with fins to prevent the cable from being caught on the upper angular corners.

A road cart has been patented by Mr. Frank Becht, of Colona, Ill. It has body supporting side bars, provided with lengthwise slots and made adjustable at their front ends, combined with pivotal supports attached to the axle, the construction being intended to render such vehicles more comfortable, alike for the occupant and the horse.

A stock muzzle has been patented by Mr. Abner Wesson, of Memphis, Tenn. It is made with hinged jaws, which open automatically when a portion of the muzzle is pressed on the ground, and close when the animal raises its head, thus allowing stock muzzled with it to feed on grass or shrubs, but preventing the biting of trees or plants of high growth.

A sash lock has been patented by Mr. Thomas A. L. Moore, of New Orleans, La. It consists of a locking dog in a case which can be secured to a window jamb, with an aperture to be engaged by a spindle, the latter having a knob and arranged in connection with a spring, which is inclosed within a case formed in connection with an escutcheon.

A spring for baby carriages has been patented by Mr. Jay F. Butler, of New York city. It is a bent spring connecting the axle with the body part of the carriage, with a tension block secured to the axle, and a clamp to fasten the spring to the tension block, in order to regulate the tension according to the weight in the carriage.

An exercising device for musicians has been patented by Mr. Julius Caesar, of New York city. It is a combination of a plate and attachable additional plates with a wristband and clamping bar, to fit a player's wrist and weighted to suit, in order to develop superior flexibility and strength in the muscles of the hand and forearm of the player.

A folding lamp shelf for pianos has been patented by Mr. Reinhard Prause, of Bastrop, Tex. An arm carrying a shelf is pivoted to the back of the music rack, the arm being arranged to swing outward into a horizontal position, and the shelf being connected with the end of the arm by a pivotal connection, whereby a lamp may be held near the music.

A gate for hens' nests has been patented by Mr. William S. Spaulding, of Paintersville, Pa. It has central bars so arranged that the hen can, by putting her head through an opening and pushing against the bars with her shoulders, easily open or close the gate, but the design is such as to prevent animals from disturbing the nest or eggs.

A tack driver and carpet stretcher has been patented by Mr. Patrick J. O'Connor, of Seymour, Ind. Combined with a slotted tube having spring jaws is a tapered hammer rod, connected to a sliding block arranged upon the outside of the tube, the tack or staple holding jaws being adjustable, and the claw serving jointly as a stretcher and a tack extractor or puller.

An atomizer has been patented by Mr. Anaximander B. Tutton, of Sioux Falls, Dakota Ter. It has an elastic bulb, with an opening to be distended over the neck of any bottle, inlet and outlet orifices, a valved tube, compressor, and pendent tube, for the production of a continuous flow of spray, through the discharge tube, of any liquid contained in the bottle.

A mechanical detecter has been patented by Mr. George H. Gaskins, of the Division of Steam Engineering, U. S. Steamship Lehigh, City Point, Va. It consists of a contact rod or bar and a conductor for conveying the vibration of the contact part to the ear, to aid in detecting when machinery is running untrue, whether a watch sounds properly, or whether working mechanical parts are in proper order.

A catch basin inlet and cover for sewers has been patented by Mr. Hiram W. McDonald, of Bucyrus, O. It has an opening in the top and receiving mouth in the side, with vertical guide ribs at the inside edges of the mouth, between which fits a detachable grate, with other novel features, and adapted to conform to the sidewalk material, and make a desirable finish and secure anchorage.

An apparatus for dyeing has been patented by Mr. Eugene Rau, of Philadelphia, Pa. Combined with a vat are rollers at the top and bottom, pressing rollers, an apron below them, a roller around which the dyed fabric is passed, and a roller on which the fabric is wound, the apparatus being especially designed for dyeing fabrics with aniline color dissolved in hydrocarbons.

A knockdown bed bottom has been patented by Mr. Reuel W. Woodman, of Bar Mills, Me. It has simple and efficient irons or fixtures, adapted to join the side rails and end bars of the bottom frame, so it can easily be knocked down for storage or shipment, and readily set up, while the springs or other flexible mattress support of the bottom may be strained up tightly at any time.

A washing machine has been patented by Mr. William M. Egan, of Salt Lake City, Utah Ter. The suds box has a close fitting cover and a false concave bottom of parallel bars, the clothes presser being a perforated board with fingers that enter and work in the grooves of the bottom, so that when the presser is vibrated it raises the clothes out of the water, squeezes, and then allows them to fall back into the suds.

A churn has been patented by Messrs. Samuel E. Foreman and Frank T. Walls, of Randolph, Kan. It has a twisted vertical shaft carrying a dasher, a block carrying an apertured plate, through which the shaft passes, and dasher blades carried by the block, in such manner that currents will be produced in four directions, to agitate the cream, the construction being very simple.

A two wheeled vehicle has been patented by Mr. Mortimer L. Knowles, of Union City, Mich. A pair of springs is rigidly fastened to the bends of the shafts near the axle, a rearwardly projecting seat bar having its forward ends loosely connected to the shafts, so as to oscillate, with clips connected to the springs by hinge joints, and other novel details, to make an easy riding vehicle, without "horse motion" to the seat.

A wood moulding machine has been patented by Mr. Walter J. Smith, of Philadelphia, Pa. It has an elastic rest, adapted to be attached to an arm adjacent to the spindle, and moulding knives, combined with an adjusting screw working in a fixture and carrying a follower or block connected to the rest, for changing the curvature of the rest, with other novel features.

A bicycle pedal has been patented by Mr. Thomas J. Strickland, of Randolph, Mass. It is formed of two end pieces, between which two U-shaped pieces of sheet metal are held by tongues formed on the end edges and passed through slots in the end pieces, whereby the pedal is made light, but strong, and so the rider's foot cannot slip, and the sole of the foot will rest only on the flat side of the pedal.

A grinding mill has been patented by Mr. Henry Cutler, of North Wilbraham, Mass. It is a vertical disk grinding mill, in which the mill case has trunnions and is provided with arms, brackets, and bearings, combined with the driving shaft, its pulley and adjusting devices, whereby the mill case and its connections are tilted, and in which the running stone may be nicely held to its work, but will give should unyielding substances get between the surfaces of the stones.

A cigar tip has been patented by Mr. Arno S. Rosenbaum, of New York city. It may be made of metal, rubber, celluloid, or other suitable material, and attached in the manufacture or by the consumer, being of suitable shape and so perforated with numerous small holes as to permit the passage of the smoke, while preventing the nicotine from entering the mouth, the tip holding a small cup with an absorbent of cotton, sponge, or other suitable material.

A rotary water meter has been patented by Mr. Franklin T. Gilbert, of Walla Walla, Washington Ter. It is an improved arrangement of rotating wheel in a case, with wings mounted upon radial axes and adapted to act like pistons to take the pressure of water coming in through an inlet pipe to turn the wheel, the wings gradually turning upon their axes into a horizontal plane in passing over an incline bed as they move toward the outlet pipe.

A bridge guard has been patented by Mr. William C. Newman, of Charlevoix, Mich. The guards consist of from one to three rods or rails extending across the bridge approach, and slide with their ends in vertical guide grooves, being adapted to be lowered by the bridge itself into deep narrow recesses as the latter is closed, and to rise automatically into an operative position as the bridge is swung open for the passage of a vessel.

A telephone transmitter has been patented by Messrs. John E. Dann and John Lapp, of Honeoye Falls, N. Y. Combined with a diaphragm having a bracket or arm carrying an electrode apart from the diaphragm, is a second electrode, which projects between the other and the diaphragm, a weight being attached to the second electrode, and a spring which supports and tends to hold it normally in light contact with the electrode attached to the diaphragm, with other novel features.

A switch and a cut-out for electric circuits form the subject of two patents issued to Messrs. John M. Fairchild and James O'Connor, of Portland, Oregon. The first invention covers a peculiar construction and combination of parts, whereby an electric current may be switched from one circuit to another, or which may serve as a cut-out for the lamps of an electric light circuit, while the cut-out is more particularly adapted for electric light circuits, whereby the lights of a building may be cut-out by the police or firemen without affecting the main line.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.