

knowledge of the last-mentioned estimates. The article being written for instruction and not for debate about conflicting and erroneous statements, I was silent about them, considering these very low estimates as entirely unreliable, and, in fact, as false statements: the reason will be clear from the following.

The whole question of course depends on the amount of water evaporated from a given quantity of fuel. It is demonstrated that one pound of coal, by the very best method of combustion, will produce 13,500 units of heat, that is, it will heat 13,500 lbs. of water one degree. Starting now with water of about 60° we have to add 150° to reach the boiling point, and adding to this the 1,000° units latent heat required to change the water into steam gives a consumption of heat of 1,150°: this divided among the 13,500 lbs. water gives nearly 12 lbs. water changed into steam by one lb. of coal: thus 3 lbs. of coal will convert 36 lbs. of water into steam. On page 22 I demonstrated that the evaporation of 9 ounces of water per minute produced a certain power which it has been agreed to call a horse-power: this is the same as $9 \times 60 = 540$ ounces or 34 lbs. water per hour, corresponding very nearly with the above amount of water evaporated by 3 lbs. of coal. This is the correct theoretical amount for low pressure steam. For high pressure there is some advantage, as is known, but not to such a degree as to account for the very low estimates spoken of above. In practice it appears that never as much as 12 lbs. of water for every lb. of coal is evaporated: we may verify this by Bourne in his treatise on the steam engine. He states (page 81) that 112 lbs. of coal will evaporate from 11 to 18 cubic feet of water; the last number corresponding with the performance of the very best Cornish boilers: this gives with 1 lb. of coal from 6 to 10 lbs. of water.

Theoretically, the evaporation of 36 lbs. of water (a little more than half a cubic foot) in one hour should thus produce a horse-power: in practice, however, it is found that a cubic foot is required, and this has generally been adopted as the nearest to the results of experience: this brings the theoretical consumption of 3 lbs. of coal to 5 lbs. at least: I adopted 4 lbs. for the minimum reached. Prof. Silliman, who is very correct in collecting his data, states in the last edition of his Physics that in England 10 lbs. of bituminous coal per hour are estimated for every horse power; that in very carefully constructed boilers this effect is reached by 7 or 8 pounds, that in the Cornish boilers with large evaporating and heating surface, the most economical in existence, 5 lbs. are used, and finally that in the United States the anthracite averages 6-25 lbs. per horse-power per hour.

Tredgold, in his practical treatise on Railroads, states, page 82, that 134 lbs. of coal per day in practice, and 82 lbs. as the lowest possible theoretical amount of coal per day for every horse-power, is the consumption for the "best locomotive engines likely ever to be invented."

Practical engineers and locomotive builders (for instance at Baldwin's Locomotive Works, in this city) will all agree when conversing with them on this matter, that practically estimating the amount of coal used per horse-power is very difficult, as it is subject to so manifold disturbing influences that the most conflicting results are continually arrived at; therefore, they never trouble themselves with such a calculation, notwithstanding there exists a rivalry on many lines between engineers to economise fuel. The consumption will in the first place depend on the quality of the coal, in which there is more difference than those who do not run engines dream of; then in drawing a railroad train it depends on the state of the weather, temperature, direction of wind, number of stoppages, but above all on the judgment of engineer and fireman, etc. On the Central Pennsylvania road from Philadelphia to Pittsburgh, for instance, of two locomotives perfectly alike in all respects, drawing loads also alike, one will use double the amount of coal used by the other, when running over the same distance with the same velocity. Sometimes the same locomotive will improve in this respect and burn less than before, sometimes the opposite takes place.

P. H. VANDER WEYDE.

Philadelphia, Feb. 15, 1867.

An Appreciative Patron.

We wish we had space to publish all the complimentary letters we receive from our patrons; some commendatory of the paper and others of our Patent Agency. But if we should publish half the number we get, we should not have room for anything else, so we forbear inserting only an occasional one. Read the annexed.

MESSRS. MUNN & Co.—It gives me great pleasure to acknowledge the receipt of my Letters Patent. I particularly admire your ability in framing my specification and claims, which secure to me more than I expected when I applied for a patent. I would say to inventors or those about to apply for patents that if they place their inventions in your hands, they will be successful if there is any novelty in their invention.

OMAR J. ARNOLD.

Mt. Ida, Grant county Wis., March 12, 1867,

KANSAN IDEAS OF COMFORT.—A subscriber residing in Kansas, after having for years been tormented by the devastations of the gopher, repeatedly losing crops, fruit trees and shrubs, has at last invented a trap which he thinks is a perfect protection, and is happy in the prospect of enjoying peace and comfort in the future. "All I now ask," he says, "is a cabinet organ, a sewing machine, a stereoscope with views, some volumes of the SCIENTIFIC AMERICAN, and half a dozen gopher traps."

MUCILAGE BOTTLE CAP.—In our notice of this cap, in our last issue, page 212, we omitted to say that the cap is made from spring sheet brass ornamented by beading and is cheaper than any other in the market. We are satisfied from trial that it has no superior among the different kinds which have come under our observation.

APPLICATION OF THE LEVER ESCAPEMENT.

[For the Scientific American.]

BY JULES D. HUGUENIN VUILLEMIN.

Of all the escapements in use the lever is the one employed as giving the best satisfaction for pocket time-keepers. There are several ways of applying it, not only in the distribution of its degrees but in the adjustment of its different parts. A Swiss firm who have succeeded in giving excellent satisfaction with their watches, adopt the straight line lever escapement with two rollers, the advantages of which may be briefly stated.

By placing on a straight line the lever and the wheel, the teeth of the latter act more equally on the pallets than when put in any other position. This has been demonstrated by several authors, to whom I refer, desiring to be brief in things which have been fully and duly explained by others.

It seems at first immaterial whether or not the center of the balance be a little nearer or a little further from the center of the lever, or in other words, have a long or short fork. As the distance from the pin jewel to the center of the balance is proportionate to the length of the fork, the connection of the levers does not change, consequently the power and resistance remaining between both in the same condition the results are equivalent.

It must be taken into consideration that with a long fork the whole lever becomes heavier, not alone by the addition of weight in the length of the fork but also by the counterpoise with which the backward part of the fork must be charged for keeping its equilibrium. The inertness of the lever and the resistance to the motive power are therefore increased, and friction becomes more extended. For a long fork it is also necessary to employ a large roller. This large roller, by overcharging the center of the balance, makes it necessary to charge also its limbs and to employ a more powerful hairspring and finally a stronger motor or mainspring. As all the resistances of the escapement are increased the causes of wear and tear are also increased proportionately. This consideration shows that it is advantageous to keep the fork as short as possible, without, however, going to extremes.

The difference between the banking generally employed and the banking of the escapement with two rollers, one specially for the banking, will now be explained. The roller used generally bears the pin jewel which receives the impulse from the split of the fork. It is only behind the split of the fork that the banking heel comes, which must be sharp or replaced by a vertical pin to approach as near as possible the center of the roller. As the banking action acts against the edge of the roller, which is somewhat outside of the pin jewel, the heel can not approach the center, and as only a little room can be made, the consequence is that when the watch receives a shock, the heel touches the edge of the roller, which interferes with the vibrations of the balance, and this may also often occur when the watch is hanging.

When the escapement is made with two rollers, the banking roller is behind the pin jewel. The banking pin is longer than the whole split of the ordinary fork, and when in motion describes a larger circle, and consequently approaches much nearer the center of the small roller, and by giving room, which can easily be done, between the small roller and the end of the banking pin, the motion of the watch can never be interfered with, either by receiving a shock or when hanging. This escapement will be found easy to make and to repair when it is by accident out of order.

Various Recipes.

TO CLEAN A SOLDERING COPPER.—Rub it when hot on a brick with rosin and solder.

ARSENICAL SOAP.—This preparation is used to preserve the skins of birds and other small animals. Take of carbonate of potash 12 oz.; white arsenic, white soap, and slacked lime, of each 4 oz.; powdered camphor, $\frac{1}{4}$ oz. Add sufficient water to form a paste.

LIQUID BLACKING.—I. Take ivory black 5 oz., molasses 4 oz., sweet oil $\frac{1}{4}$ oz.; triturate until the oil is perfectly killed, then stir in gradually vinegar and beer bottom of each $\frac{1}{2}$ of a pint and continue the agitation until the mixture is complete.

II. Take ivory black 1 lb., molasses $\frac{1}{4}$ lb., sperm oil 2 oz., beer and vinegar each 1 pint; proceed as before.

FRENCH POLISH FOR BOOTS AND SHOES.—Logwood chips, half a pound; glue, quarter of a pound; indigo pounded very fine, quarter of an ounce. Boil these ingredients in two pints of vinegar and one of water during ten minutes after ebullition, then strain the liquid. When cold it is fit for use. To apply the French polish, the dirt must be cleaned from the boots or shoes; when these are quite dry, the liquid polish is put on with a bit of sponge.

SOLDER FOR BRASS INSTRUMENTS.—An alloy of 78.26 parts of brass, 17.41 of zinc, and 4.33 of silver, with the addition of a little chloride of potassium to the borax, is recommended by Mr. Appelbaum as the best solder for brass tubes which have to undergo much hammering or drawing after joining.

WATER-PROOF COMPOSITION FOR LEATHER.—Melt together 1 lb. tallow, $\frac{1}{2}$ ounce neatfoot oil, 1 oz. of rosin, $\frac{1}{2}$ ounce lamp-black and a tablespoon full of boiled linseed oil. Should be rubbed in repeatedly, the boots or other articles to be warmed. It is said to be perfectly water-proof and not injurious to the leather.

THE CHICAGO TUNNEL was opened to the waters of the lake on the 7th inst., by four men who walked through it from the shore and ascended through the lake shaft; the ice having rendered it impossible to get at the flood gates by means of a steamer. The men, after opening the gates, were obliged to wait there until a boat could be got within their reach.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

CHURN DASHER.—Anson A. Avery, Cardiff, N. Y.—This invention relates to an improvement in churn dashers, and consists in forming a dasher with a series of bars fluted and slotted in such manner that the air is caught under and forced through them with the cream so as to thoroughly intermingle in their passage through the bars and thus produce the effect of an atmospheric churn upon the cream, bringing the butter quickly.

PORTABLE BOX FOR PROTECTING TREES.—Henry A. Graef, Brooklyn, N. Y.—This invention relates to an improved mode of constructing boxes for protecting young trees when planted out where they are exposed to injury from the destruction of the bark by cattle, etc., and consists in forming them of upright wooden slats or metal strips which are attached to wooden or sheet iron hoops or bands.

HAY LOADER.—E. C. Green, Plainfield, Ind.—The object of this invention is to load hay or corn fodder upon wagons, either from the shock or the windrow in the field.

SPRING BED.—David Manuel, Boston, Mass.—This invention relates to improvements in the construction and arrangement of a spring bed and consists in a new mode of forming the springs and connecting them to the slats and bedstead, which secures an easy and gentle pliability and elastic power in the springs.

ICE CREAM FREEZER.—H. B. Masser, Sunbury, Pa.—This invention relates to an improvement in ice cream freezers, and consists in arranging a rotary freezing can in combination with a rotary heater in such manner that the can and the heater shall each have a distinct and separate motion independent of the other, or a joint motion when desired; and also an improved mode of packing the side of the heater.

CLOTHES TONGS.—Benedict Ott, La Crosse, Wis.—The object of this invention is to provide a convenient utensil for the use of women in washing clothes whereby they can lift and handle clothes when hot in a boiler or tub without exposing themselves to being scalded, or when in excessively cold water for rinsing, etc., without contact of the hands to chill them.

ATMOSPHERIC FOUNTAIN.—John Ross, Greenville, Mich.—This invention consists in improvements in a parlor atmospheric fountain, rendering it more convenient, cleanly and ornamental, by the application of a pump for elevating the water to the upper chamber and a novel arrangement of pipes conveying air and water to the different chambers.

DEVICE FOR SETTING UP BARRELS, CASKS, ETC.—C. B. Hutchinson, Auburn, N. Y.—This invention relates to a new and improved device for setting up barrels, casks, etc., whereby the staves previously chamfered and crozed may be set up around their own head, the use of truss and hoops avoided or rendered unnecessary, the barrels or casks all made of an uniform size, and the work performed expeditiously and in a perfect manner.

GUN WORMER.—Henry C. Bascom, La Crosse, Wis.—This invention relates to an improvement in gun wormers or a screw in a ram rod for extricating bullets or a wad from the barrel of a gun and consists in so arranging it in connection with a thimble or case fastened on the end of the ramrod that it may be drawn within the case or protruded therefrom as required, by a screw or slide movement.

COOK STOVE.—Seymour Raymond, Middletown, Pa.—This invention relates to an improvement in the tops of cook stoves and consists in making the division plates for the pot holes in such manner that they may be reversed in their position or turned up side down for the purpose of equalizing the action of the heat and preventing them from becoming warped and ruined by the constant action of the fire on one side only to which they are exposed when the plates are not reversible as commonly constructed.

PAD FOR LATHES FOR HARNESS SADDLES.—Palmer Shaw and Edward S. Dawson, Syracuse, N. Y.—This invention has for its object to furnish an improved pad plate for harness saddles, which shall be light, strong and easily and cheaply constructed.

METHOD OF APPLYING HOOPS TO BARRELS.—Daniel and Edwin Perry, Pawtucket, R. I.—This invention consists in constructing conave bands or hoops, and applying them to barrels, tubs, pails and butter molds by cutting two parallel channels or grooves on the exterior surface of the barrels or tubs at the same distance apart that the hoop is designed to be wide.

METALLIC GAGE HEAD AND FASTENER.—Peter Lawyer, Richmondville, N. Y.—This invention has for its object to furnish an improved gage head simple in construction, easily, quickly and accurately adjusted, and which when its face has been once made at right angles to the rod will always remain so.

HERNIA TRUSS.—William Pomeroy, New York City.—This invention has for its object to furnish an improved truss so constructed and arranged as to give an upward and inward pressure, which may be shortened or lengthened to perfectly adjust the pad to the hernia; and which will not allow the movements of the body to interfere with the position of the pad over the hernia.

SCREW VALVE.—John Wilcox, Thompsonville, Conn.—This invention consists in constructing a valve, and in attaching it to its seat and operating it by a screw in such a manner as to adapt it to various purposes, whereby many difficulties which have hitherto been experienced in opening and closing apertures for the admission or discharge of air, gas, steam or liquid is overcome.

MACHINE FOR MAKING CARRIAGE BOLT BLANKS.—William Koplin, New castle, Pa.—This machine cuts off a suitable length of bar, grasps and points it, upsets it so as to form a square portion between the head and the end longer in diameter than the latter, and lastly swedges a raised head completing the bolt blank which is discharged by a hook which drags it from its bed and drops it to the ground.

MACHINE FOR FORMING EAVE TROUGHS AND CONDUCTOR PIPES.—A. Calkins and Wm. Tower, Almont, Mich.—This invention has for its object to furnish an improved machine by means of which the manufacture of eave troughs and conductor pipes may be greatly facilitated.

AXLE BOX COVER.—Richard McDowell, Lambertville, N. J.—The object of this invention is to provide a cover to axle boxes of railroad cars which can be easily removed and replaced for cleaning, lubricating and other purposes.

MACHINE FOR CULTIVATING AND PLANTING.—Isaac H. Chappell, Decatur, Ill.—This invention has for its object to furnish an improved machine that can be readily adjusted for use either as a cultivator, planter or seeder.

COTTON BALE TIE.—Daniel M. Sechler, Cincinnati, Ohio.—This tie consists of two loops around which the respective ends of the hoop are bent and replicated; the smaller loop is then passed through the larger at a certain point and being slipped back is retained at the narrow portion of the opening in the larger portion.

CHURN.—John Megown, New London, Mo.—This invention consists principally in the construction of the churn, and in the combination and arrangement of the operating parts with each other and with the hinged lid so that the said operating parts may be removed from the churn by simply raising and turning back the lid.

SIGHT FOR FIRE-ARMS.—Williston Conner, Rensselaerville, N. Y.—The object of this invention is to construct an accurate sight which can be quickly adjusted to any range and which may be removed below the line of range of a fire-arm to which it may be attached so as not to obstruct the use of the intervening sights. With a slight modification the same device may be used for adjusting telescopic sights on fire-arms.

CRYSTAL SIRUP.—H. C. Becker, New York City.—This invention relates to a new composition for making crystal sirup, which when added to sugar prevents graining and fermentation of the same, and which is also of great value when used for preserving fruit.

SAW GUMMER.—James E. Emerson, Trenton, N. J.—This machine consists of a rotary cutter mounted in a frame which may be attached to the saw blade at will by means of thumb screws used both as clamps and pivots, and an adjustable handle by which the pressure may be always applied in the plane of resistance.