

lows, therefore, that, could all the heat which is disengaged from a pint of water, in the act of freezing, be made suddenly to pass into a pint of water at 72° , it would cause it to be heated to 212° , or to the boiling point. This large quantity of heat which is disengaged, when water becomes ice, is the reason why the operation of freezing is a very slow one; the water is kept at 32° , by the heat, separated from that portion of itself, which is freezing; and this heat has to be carried off by the colder atmosphere, by which it is surrounded, before another portion can begin to freeze.

In the next number of the *Artisan*, we shall pursue this subject, and shall continue it until we have introduced all those substances and processes, the explanation of which may appear to us most likely to aid the artisan, in the acquisition of first principles. This department will not be restricted to chemical science, although to this will be allotted, a distinct and separate place.

Mechanics, and others, who desire information respecting *terms*, or *processes*, in the different departments of art or science, are invited to send their enquiries, which shall either be answered by us, or be inserted, in order to obtain answers from others.

On Chronometers and Expansion Curbs. By BENJ. F. BAKER.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR—In the third number of the first volume of the Franklin Journal, I gave a short paper upon the balance of chronometers, as operated upon by the atmosphere. Further observations, since that time, upon these instruments, have not in the least weakened the opinion, then expressed, upon the adjusting screws and loadings; but it is instantly asked, by the practical mechanician. In what way is the time to be preserved uniform, through greatly differing temperatures? The resort must necessarily be to the curb. Suppose, for example, the common lever curb, and flat hair spring; the pins of this curb are to be set so close together, as just to admit, freely, the spring between them; and are to be so shaped, that each pin will present to the spring, a very small surface. (say the edge of a triangle,) that, however long the vibration may be, only the same space upon the spring, will be touched by these pins. Let the chronometer be regulated, precisely as the lever now is, to a tolerable degree of accuracy, before the expanding and contracting attachment, is secured to it. This attachment must be made to act upon the curb itself, so that, when it expands by heat, it will move it (however little) along the index, towards the word *fast*; and the contrary way, towards the word *slow*, when it contracts by cold. This expansive appendage to the curb, may be made, or bent, into various shapes, in order to obtain an operative length of the compounded metals, and be simply screwed to the plate at one end, and to the curb at the other. The first inquiry naturally starting from the ideas of a practical man, will be, how to

bring about a proper quantity of action upon the curb, so as to only, and not more than, counteract the effects of heat and cold upon the timekeeper. This may be accomplished in various ways. Let the screw, that secures it to the plate, instead of passing through a round hole, pass through an oblong one; then, by drawing this screw a little, the end attached to the curb may be moved inwards, or outwards, thus, as it were, shortening, or lengthening, the lever acted upon. This will also be found convenient, when it is thought necessary to reduce the rate of the chronometer; for, by easing this screw, as in the first instance, the expansive attachment may be moved with the curb towards advance, or retard, sliding under the screw-head, it will preserve its relative bearing when again secured.

There are many other ways, by which the expansive curb may be made to act *parallel to the hair spring coil*. The above is given in explanation of the general idea; for it is the *principle* that I would illustrate and recommend, rather than any particular way of applying it. The objection to the expansive curb, now used in lever watches, is, that the action *crosses* the coil of the spring, and tends, as it were, to open, and close, the curb pins. The result will be, that when the curb is adjusted to different temperatures, (which can only be done by much care and observation, during cold weather,) while the oil is fresh in the pivot holes, and the vibration of the balance, long, the same relative effect on the time will not be produced, when the vibration shortens by the evaporation, or thickening of the oil. The expansive curb is generally to be found in all the highest priced lever watches, that come to this country; and yet, the writer never, in a single instance, found one that had been adjusted, even in the slightest manner, to different temperatures. Placed in the watch, merely to add a sounding epithet to its description, and a guinea to its price, they are not only utterly useless, but, in many instances, destroy the regularity of its performance. I have such a one in my shop at the present time, made at an establishment, equal, perhaps, in reputation, to any other. The expansive curb of this watch is so straight, that, at every vibration which opens the coil, the spring touches it nearly the sixteenth of an inch along the end that takes the place of the outer pin. This is so great an error, that it is impossible for the watch to perform with any proper degree of regularity; for every accidental shake it may receive, that widens the motion, the balance receives an additional impulse; and a diminished one, if the shake should shorten the action. I have been thus particular in noticing the ordinary expansive curb, from a belief, that foreign machinists must smile at our simplicity, in ordering, and paying for, a thing which is not merely useless, but injurious to the time of the watch that contains it.

The chronometer scapement, divested of its loaded balance, made, and placed with accuracy, and also with a view to prevent its setting, when used for the pocket, is, beyond all question, the best mechanical arrangement for a moveable time-keeper, that has been discovered. Completely detached in its action, the balance receives

its impulse directly from the crown wheel, at a distance from its pivots, nearly, or quite equal to, the whole space between the teeth of that wheel. In no other scapement, can this be accomplished. It is acted upon with less friction than any other, because the impulse given, follows more nearly the direction through which the balance moves, and, consequently, not being an angular rub, the points of the crown wheel teeth, will do perfectly well without oil; which is an important consideration. But the most general objection urged against the pocket chronometer, is, its liability to set, from being jolted, by riding on horseback, or otherwise. This is owing partly to the loaded balance, but mainly to the improper manner in which the scapement is arranged. I have seen many of them with the under pallet placed considerably out from the stem of the balance pinion; and the same pallet also stood so far round from the feather spring, when at rest, that it required a shake, throwing the balance through nearly half a circle, to start the chronometer; and its whole action, when going, did not reach a revolution. Such a watch could not, perhaps, be carried by an active person a single week, without stopping. This is an error of application, not of principle. The three pallets of a chronometer, together with the feather spring, can be so arranged, as that, by shaking the balance through *one-tenth* of a circle, the instrument will start. I have altered them to *one-eighth*, which is done by simply turning round the under, or striking off, pallet, so that, when the hair spring is at rest, that pallet will stand nearly parallel to the feather spring; then, by arranging the other parts, so that the scapement will act properly in accordance, a very slight motion will start the chronometer. With an *unloaded* balance, and a force of main-spring, equal to what is usually put into the lever, the vibration will, probably, reach a revolution and a third. What jolt, then, can possibly check such an action to the *tenth*, or even the *eighth*, of a circle?

BENJ. F. BAKER.

April 9th, 1827.

Description of an improved Syphon, and a Self-regulating Water Gate, for obtaining a regular and equable supply of Water, from Reservoirs, for Canals, and for other purposes. By S. H. LONG, Colonel of Topographical Engineers.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR—I take the liberty to communicate, for publication in your highly useful magazine, should you think it worthy of a place, a brief description of an improved Syphon, and Self-regulating Water Gate; either of which may prove serviceable, in draining water from reservoirs, for the supply of canals, and in other cases, where a regular and equable discharge of water is required. The plans under consideration, being analogous, and requiring nearly the same ad-