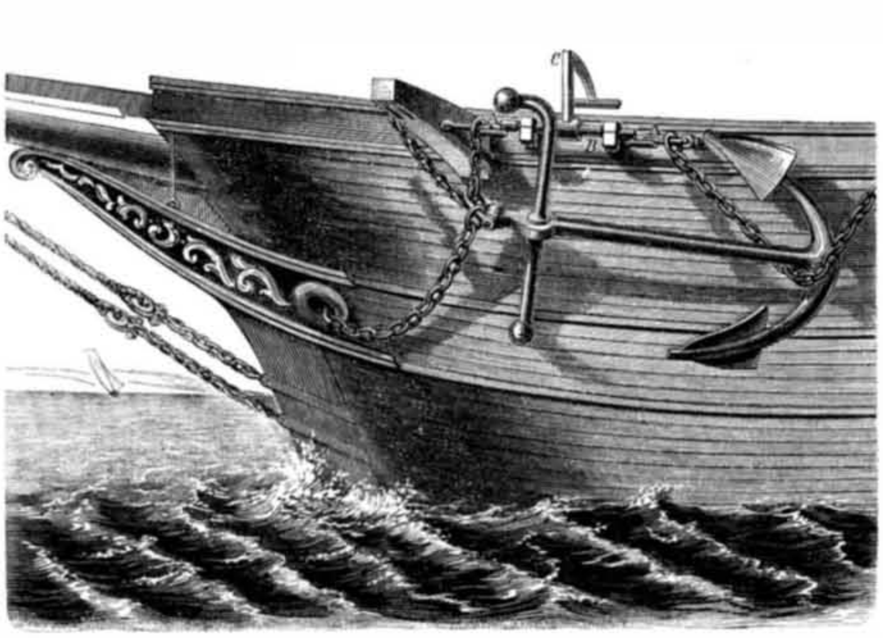
Improved Device for Tripping Anchors.

The ordinary mode of hanging a ship's anchor is by securing its ring near the cathead by a chain called a "ring-stopper," and bringing its flukes well up to the rail by means of a chain called the "shank painter" which passes around the shank of the anchor. The ends of these chains are fastened upon fixed hooks, or their equivalents, and when it becomes necessary to let go the anchor its fluke end is raised and one of the flukes hung on the rail until the end of the painter can be released, when the anchor is swung forward far enough to slacken the ring-stopper and allow one of its ends to be released, when the anchor may be let go. These successive operations require the strength of several men and a good deal of time, at a period when the labors of the men are required elsewhere and the time is of the greatest value.

The object of the anchor tripper seen in the accompanying engraving is to save this labor and time, and permit the anchor to be tripped instantly under all circumstances, which must be of very great value in cases of emergency when the lapse of a few moments may involve the loss of the ship.



HEITMANN'S PATENT ANCHOR TRIPPER.

With this improvement both the ring-stopper and shank-painter are retained, but only one end of each is secured on fixed hooks, the other ends being held on pivoted latches, A, which, when not held in a horizontal position, are allowed to swing freely in a vertical plane. They are thus held by a bar, B, called a "keeper," which is sustained in bearings on brackets projecting from the ship's side. Each end of this keeper is off set and concaved to receive the ends of the latch bars as seen in the engraving. A bent lever, C, is securely fastened to the keeper by which it may be operated from on deck. This lever is represented in the engraving as partly raised so that its form may be seen; but when in its normal position, with the anchor slung, it rests upon the rail. It may be secured here by a catch if desired, but it is so shaped as to render its accidental displacement hardly possible, even without such precaution.

In operation the anchor is brought up to its proper position behind the cathead when the free end of the ring-stopper is passed through its ring and over the latch, A, which is then rested in the concave portion of one end of the keeper. The free end of the shank painter is then passed under the shank and the ring on its end slipped over the other latch, which is placed in the corresponding receptacle at the other end of the keeper. To trip the anchor it it only necessary to raise the lever, C, sufficiently to release the latches, when the anchor descends, held only by the cable through the hawse hole. This simple operation can be performed in an instant by only one man. The advantages of such a device are obvious to all those whose experience on the sea has learned them wisdom. It was patented through the Scientific American Patent Agency by Capt. B. H. Heitmann, who may be addressed at Galveston, Texas, relative to the sale of rights or the disposal of the whole patent.

GOULD'S STOPPLE FOR SODA-WATER BOTTLES.

The design of the device shown in the engraving is to afford a ready means of opening and closing the aperture of soda-water bottles, the stopple being always attached to the

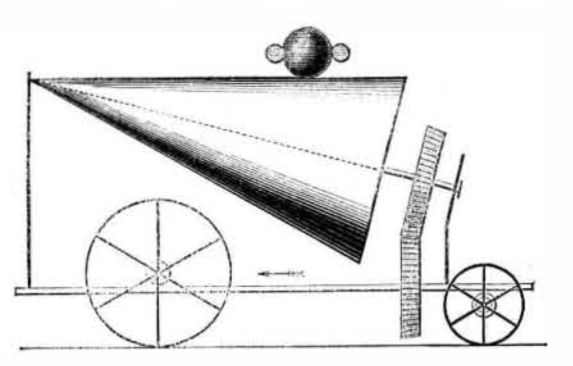
receptacle of the liquid. The stopple is simply a globe of rubber, or of any other elastic substance, turning on an axis passing through its center, the bearings of which are eyelets of metal to prevent wear. Around the neck of the bottle is a coiled spring, a portion of which passes through the sphere that forms the stopple and acts as the axle on which it turns. By the pressure of the thumb on the side of the stopple it can be rolled from its seat and returned, the tension of the spring retaining it accurately on its seat.

With this device there can be no loss of stopples. The enormous waste and consequent expense of corks is a very serious item of cost in securing the mouths of bottles, but in this device is entirely prevented. Patented July 30, 1867, by John H. Gould, Newburyport, Mass., who will reply to all interogatories relative to the improvement.

DYNAMOMETERS AT THE PARIS EXHIBITION.

The friction brake is a very rude instrument for the refinement of modern engineering and machine making. It is a very useful and simple contrivance, and it is adapted to tell approximately how many horse power a water-wheel or a windmill gives out in its action, or how much power is consumed by a millstone or other uniformly rotating mechanism. But when it comes to the investigation of more complex and irregular movements, when such a question arises as what precise point or portion of a curved cam suffers the greatest strain during its revolution, and what proportion this strain bears to that which cams of other shapes or curves will have to undergo if substituted for the first, when it comes to watch and compare the relative consumption of power between different spinning and weaving machines, or between different headstocks of a mule, or between differently constructed parts of a single mule headstock—then the friction brake of course is no longer applicable, and a delicate, scientific, yet simply constructed instrument becomes a generally acknowleged desideratum. Such an instrument is what engineers now call a rotation-dynamometer, and a perfect instrument of this kind is yet to be designed. The name rotation-dynamometer is given to distinguish it from those instruments which measure and register linear exertions of power, or forces exerted in a straight line, such as the pull of a locomotive engine or of a tug-boat Dynamometers of that kind present no difficulty in their construction, and there exist a considerable number of such instruments all practically perfect, or nearly so, in their action and performance. Most of these instruments are based upon the production of a diagram, one element of which is represented by the tractive force or linear strain exerted, while the other element represents the time or space of movement through which that exertion had taken place. The area of that diagram representing the product of the tractive effort multiplied by the space through which it has been exerted gives the precise amount of work performed. The form and outline of the diagram itself in those instruments which produce a visible diagram of that kind indicates at the same time the precise fluctuations, changes, and other characteristic features connected with the exertion of power, and thereby gives one of the finest, most trustworthy, and useful records of the performances of machinery which we have in practical mechanics. The steam engine indicator is in reality nothing but a linear dynamometer registering the exertions of the steam pressure as connected with the space traveled through by the piston, and it is certainly one of the finest, most suitably contrived, and most perfect instruments at present at the command of mechanical engineers. For a rotation-dynamometer, the problem consists in producing the same register of power and space with regard to rotatory movements as the indicator gives for a straight-lined exertion of power. We require a diagram showing the amount and variation of power exerted upon a pulley by the belt running over it during the time that any given machine which is driven by that pulley performs its operation. The dynamometers hitherto made for this purpose suffer from several defects. Most of them are complicated and costly instruments, difficult to keep in order, and unreliable in their indications. Others of a simpler nature are interferred with in their indications by alternation of friction and other elements, such as the centrifugal force, which, varying in amount with the speed of rotation interferes with the indications of the dynamometer, which are then correct only at one given speed, and more or less far removed from the true mark as the speed differs from the normal velocity. The Exhibition contains two rotation-dynamometers; they are the best of their kind ever made, and both invented in France. Still our general remarks apply to both of them, and they leave plenty of room yet for any really simple and practical instrument of their kind. The two dynamometers we speak of are those of M. Taurines, in Paris, and of M. Engen Bourdon, the well known engineer of the same town. The dynamometer of M. Taurines is a very complete instrument. It was invented some five years ago, and used in a series of experiments made for determining the power consumed by different engineers' tools at the workshops in Indret, apparently with much success. It consists of a pair of pulleys mounted upon a solid shaft and upon a surrounding hollow shaft respectively, and connected together by a pair of segment springs. The transmission of power from one pulley to the other, through the action of these springs, causes the latter to alter their shape, and thereby a tension is exerted parallel with the axis of the two shafts which carry the pulleys. In this direction a small carriage, moving on four wheels and upon a pair of straight horizontal rails, is attached to the springs by a connecting rod, and this carriage is traversed forward and backward upon the rails, according to the action of the measuring springs connected to the two main shafts. The position of the carriage on the rails is therefore equivalent to the strain exerted through the pulleys, and corresponds to the position of the pencil point in the steam-engine indicator. The second element, or the space traveled through, corresponds to the number of revolutions made by the pulleys, and this is transmitted to the indicator in the following way :—

The carriage previously referred to carries upon its frame a long nicely finished cone, which revolves round its own axis in two bearings, mounted so that the upper line of the cone remains always horizontal. This cone is geared by a pair of bevel wheels, so as to revolve with the two driving-pulleys and to make the same number of revolutions. At the top of this cone, and in frictional contact with it, is a sphere guided between rollers which are also in frictional contact with the sphere. The contact between the cone and the sphere, theoretically, is a mathematical point, and this point corresponds to the pencil-point of the other indicators. Now as the cone revolvolves, the sphere follows the movement of the point of contact, and receives an amount of motion which is due to the circle described by the point of contact upon the surface of the cone during the revolution of the latter. The position of the carriage and cone upon the rail is therefore the element which determines the size of the circle of contact between the cone and the sphere. The annexed diagram shows the relative



position of these elements, and it will be seen from it that the movement of the carriage in the direction of the arrow brings the broader part of the cone in contact with the sphere, and that for one revolution of the cone the sphere will make a greater number of turns in proportion to the increased diameter of the circle of contact. The number of revolutions made by the sphere, and counted by a common engine counter moved from one of the small friction guides, is a fraction of the product of power and distance traveled through, or an equivalent to the work performed. It is necessary only to read off the figures of a suitably arranged counting apparatus to arrive immediately at the power indicated by this instrument, and so far, its use is very convenient; but, on the other hand, it cannot be denied that the apparatus is very complex, and that its elements are liable to derangements and inaccuracy on account of slip, particularly when exposed to sudden changes of power. M. Bourdon's dynamometer consists of a pair of pulleys, each on a separate shaft, and the two shafts are geared together by means of a pair of spur-wheels with inclined teeth. The inclined gearing exerts a longitudinal pressure proportionate to the strain transmitted through it, and due to the angle of the teeth. There is therefore an end thrust caused by this gearing, and this is taken up by one of the shafts which is free, endways, in its bearings, and presses endways against a spring. The spring transmits its movement to a pointer, and in this manner the amount of strain transmitted is registered upon a scale. This instrument, although simpler than the first, is liable to be interfered with in its indications by the changing influence of friction, and so we find ourselves compelled, in the face of those two best indicators yet made, to declare that an absolutely perfect instrument of the kind yet remains to be invented.—*Engineering.*

WATCHES AT THE EXPOSITION.

No section of horology shows greater advance since the Exhibition of 1851 than that of pocket chronometers and watches. The most striking feature is an improved proportion of all the works; but the most essential points of improvement are the increased weights and diameters of the balances, the importance of which in the construction of a pocket watch is now fully established. Although France makes a larger exhibition of watches than England, those exhibited by the latter country are decidedly the best.

The escapements principally in use formerly in watches were the chronometer or detached escapement and the duplex; these, though excellent in themselves, are not well adapted for these railroad days, because they will not bear rough usage. They have accordingly been almost entirely superseded by the lever escapement, which is particularly suited for all the ordinary usages of life; and, when all the other parts of the watch are of the same quality as the pocket chronometer, a most reliable timekeeper is obtained. A watch with an uncompensated balance spring is seriously affected by changes of temperature, particularly when not worn habitually. Ten degrees of Fahrenheit causes a watch to vary seven minutes per week; hence the difficulty of regulating watches, except to the owner's particular wear; yet, if a watch be regularly worn, it is remarkable how nearly this error is balanced.

Great pains have been taken during recent years in England to improve the manufacture of ordinary watches. The best works are made in the Lancashire villages, and a considerable quantity of these works are annually exported to the United States, where they are cased and finished. According to the census of 1861, 23,427 persons were engaged in that year in the watch trade in England, the greater portion of whom reside in Lancashire.

Though the first-class chronometers in France are, as a rule, inferior to those of English manufacture, they are—and especially when considered in relation to the very important question of price—very remarkable for their general excellence. Pocket chronometers and watchmaking have been hitherto but a very secondary manufacturing interest in France; but of late years it has greatly revived.

It is, however, in cheap watches that France makes the greatest show. The efforts made by M. Goutard, of Besançon, to revive watchmaking in France, which were rewarded by a medal in 1862, appear to have been very successful. The clock and watch trade of France has, indeed, acquired enormous proportions during recent years. It is officially represented as amounting to 35,000,000 francs annually. The principal seats of the trade are for clocks, Paris; for watches, Besançon; and for large turret clocks, Monez (Jura). At Besançon 15,800 men, women, and children, are employed in the manufacture of watch movements. There are 132 workshops, and 150 houses in the trade give out work to be executed in the private dwellings of the artisans. The Besançon watch trade manifests considerable improvement since 1855. Of 223 exhibitors in the French department of watches and their movements, ninety-seven come from Besançon. In 1845 this town produced 51,191 watches; in 1855, 141,043; in 1865, 296,012; and the number is now said to surpass 300,000 annually. The declared official value of the watches and movements in 1866 was 17,000,000 francs. The principal establishment at Besançon is the Ecole Municipale d'Horlogerie, which maintains 250 pupils, and is directed by a professor.

There is also a large watchmaking trade carried on at the Cluses (Savoy), where there is a school for teaching watchmaking. St. Nicholas d'Aliermont is an important seat of this art; out of an adult population of 2,500, upwards of 1,000 are engaged in watchmaking. Astronomical clocks and chronometers are also fabricated here. The total number of timepieces annually made in this town is stated to be 144,000, valued at upwards of 1,000,000 francs. They are for the most part sent to Paris. It is worthy of remark that for the more delicate workmanship women are preferred, at St. Nicholas d'Aliermont, to men.

An attempt has been lately made by some Paris watchmakers to introduce a decimal system of time in watches, dividing the day into ten hours, the hours into one hundred minutes, and the minutes into one hundred seconds. The best illustration of this decimal division will be seen in the watches exhibited by F. Cacheleux (France.)

The watch manufacture of Switzerland is represented in the present Exhibition by one hundred and sixty-three exhibitors, sixty-seven of whom come from the Bernese Jura. It is not a little curious that, while France is now endeavoring to supplant Switzerland in the manufacture of cheap watches, the watch trade of the latter country appears to have come from France, which enjoyed a monopoly in making these instruments when their manufacture was unknown in Switzerland. This branch of industry, for which the latter country is so remarkable, is of comparatively recent growth, and is said to have been founded by French refugees who fled to these mountain villages for shelter from political persecution at the close of the last century. Even as late as fifty years ago it had not grown to any great extent; factories were few in number; a large number of the watchmakers being agriculturists or small farmers, who in the winter season devoted their time to watchmaking.

The repeating motion, for which Swiss watchmakers are now celebrated, had its origin in England; and when such complicated mechanism as that involved in the construction of a repeater is considered, it is evident that there must have been a large amount of mental mechanical ingenuity among the Swiss, for they had formerly little communication with England or France, access to these countries being difficult; and yet in a very short time after the art of watchmaking was introduced into Switzerland good watches were made, including beautiful and accurate repeaters. In 1851 the watch trade had grown to an enormous industry, some of the Swiss houses making as many as 500,000 watches yearly, and a large number running out their 10,000 and 20,000 per annum. These watches are not, of course, either of high class or high price. Most of the works continue to be made in the country parts of Switzerland; but those with beautifully finished cases and delicate workmanship are principally constructed in Geneva. The movements are almost entirely made in the Val de Joux, by various hands. A remarkable exception may be seen in the case of a repeater exhibited by August Baud (Switzerland, 3), all the parts of which have been constructed by himself. Watches will be found in this department from the humble, but by no means rough, watch, of 8 francs, to the pocket chronometer of 1,250 francs. Among the cheap watches are some curious specimens constructed, for exportation to China. A school for teaching watchmaking, founded in Geneva in 1824, turns out exceedingly fine work. Pupils are admitted at the age of fourteen, and many remain in the establishment four years and a half, during which time they are taught all horological processes. The terms are—for natives of Switzerland, 5 francs a month; and for those of other countries, 20 francs. Natives of Switzerland also enjoy the advantage of being provided gratuitously with all necessary watchmaking tools. During the winter months the pupils have the privilege of attending gratuitous courses of lectures, given in the evening, on geometry, mechanics, and linear drawing. There are also four other schools in Switzerland, with professors at their heads.

The chief characteristic of the Swiss first-class watches is their horological ingenuity. Many combine movements of an extremely complicated nature, while the finish of the cases in the majority of the specimens exhibited leaves nothing to be desired.

Those interested in the curiosities of watchmaking will find in the French as well as in the Swiss department several extremely minute watches. The smallest is that exhibited by A. Rodanet & Co., which is set in the stem of a gold pencil.

It is worthy of notice that the fusee on which the English watchmakers rely so much in the construction of their best watches is entirely suppressed among the Continental makers. The absence of this important movement can only be accounted for by a desire to produce a cheap watch. Winding with the pendant—or, as it is popularly called, the keyless watch—is very general among the watches exhibited. This invention, however, is by no means so novel as is generally supposed, having been first introduced by Mr. John Arnold in 1823, for the convenience of a naval officer who had lost his right arm.

L. Gindraux, and R. Claxton, and S. Holdsworth, exhibit very complete and in many respects remarkable collections of clock, chronometer, and watch jewels, set and unset. They consist of diamonds, rubies, sapphires, chrysolites, garnets, and aqua marines, which are the stones used for horological purposes. There are jewel-holes of every description, clock and chronometer pallets, ruby rollers for the duplex escapement, ruby cylinders for horizontal movement; solid chronometer rollers, which serve the purpose of impulse and roller combined; ruby pins, flattened, oval, and triangular; caps and points for marine compasses, and draw-plate holes capable of drawing gold wire from 1,000 to 2,500 yards to the ounce troy. Mr. Holdsworth has also a case of assorted watch jewels for exportation, in order to meet a want long felt by watchmakers living at a distance from the place of manufacture, by which means they have a regularly assorted number of jewels in different sizes.

Switzerland exhibits a great variety of watch movements, jewels, and dials. The glass dials, with gold enamelled figures, exhibited by Corcelle-Tournier & Co., are extremely beautiful, and highly deserve examination.

Some machines are also shown in the Swiss department of ingenious construction, applicable to the manufacture of clocks and watches. It is worthy of remark that the clockmakers were the first who employed special machines for their manufacture. Their wheel-cutting engine has been ascribed to the celebrated Dr. Hooke, who is said to have invented it in 1655. Its use rapidly spread through England and the Continent. The gradual improvement of this machine, and the successive forms which it assumed as the art of construction was matured, form a very interesting history. English clockmakers have largely contributed to its perfection. Henry Sully, an English clockmaker, who removed to Paris in 1718, carried with him, among other excellent tools, a cutting-machine, which excited great admiration in that city. The form of the Continental engine is, however, derived from the engine improved by Hulot, in 1763. The fusee engine, which is another special clockmaker's machine, has also tended greatly to the perfection of machines for working in metal; and in many other ways the horologist has been of signal advantage to mechanical science.

There is, indeed, no branch of mechanical art on which man has devoted more labor than that relating to horology. Many artists in watchmaking work at artizans' wages, and many horologists of various countries cultivate their art *con amore*, devoting themselves to its improvement with extraordinary energy and assiduity.

The advantages to be derived from the possession of a clock or watch of perfect accuracy (were such a thing possible) could hardly be over estimated. The science of astronomy in particular would receive important benefit from such an instrument. But as no time-keeper has yet been constructed that can be relied on as being absolutely free from error, it is evident that there is still room for improvement. The sources of irregularity have long engaged the attention of many able scientific investigators; and, as we have seen, very numerous contrivances for counteracting them have been devised.

An impartial examination of the progress made in horological science since 1862, as represented by the Paris Exhibition of this year, is highly satisfactory. Absolute perfection has not, indeed, been obtained; but great progress has been made, and the result is that excellent timekeepers are much more common than they were a few years ago; and their prices, although wages have risen considerably during recent years, are much less than they were.—*Illustrated News.*

Science Familiarly Illustrated.

Chemistry of a Cup of Tea.

A little shrub grows in various parts of the world, principally in China and Japan, which produces leaves of a very remarkable chemical character; and vast numbers of people of all nations have somehow acquired the habit of steeping the leaves in water, and using the infusion freely as a beverage. The plant (*Thea Sinensis*) is a polyandrous evergreen shrub, growing three or four feet high, and bearing a white and somewhat odorous flower. According to botanical classification, it belongs to the camellia family, and is therefore allied to the beautiful flowering shrub which adorns our greenhouses and gardens.

It was evident to the earliest consumer that tea contained some mysterious principles which distinguished it from all other productions in the vegetable world but it remained for modern chemistry to unravel the mystery and point out the peculiar nature of these agents. Chemistry has solved many curious problems in the world of organized matter, but scarcely any more interesting than those connected with the tea plant. We learn from its teachings that there is stored up in tea a complex substance identical in composition with that found in coffee, cocoa and mate. It is called theine. This substance in coffee is called caffeine; in cocoa or broma, theo-bromine. Although the names are different, they are essentially alike in chemical composition. Tea affords a much larger amount than coffee; and the caffeine of commerce is in fact prepared by manufacturing chemists, from tea. Theine or caffeine is used to a considerable extent by physicians of the homœpathic school, as a hypnotic, or medicine for producing sleep, their theory leading them to employ an agent which causes wakefulness, to cure it. The element nitrogen enters largely into the composition of theine; and wherever we find this predominating in any alimentary substance, we may be sure that its effects upon the system will be of a marked or active character. Theine is prepared in the laboratory upon a large scale from spoiled tea, or that which is damaged in transportation black tea being preferred, on account of its affording a better yield. One hundred pounds are usually manipulated at once, and from this amount about twenty-six or twenty-eight ounces of beautiful white, silky crystals of theine are obtained.

Besides this remarkable principle, tea contains tannic acid, to which it owes its astringency; a volatile oil, to which it owes its peculiar aroma; a large amount of caseine, and other substances common to all plants.

In order to present more clearly or precisely the chemical nature of tea, we may state that one pound of good tea contains about a third of an ounce of theine, two and a half ounces of caseine, one-twelfth ounce of volatile oil, two and a half ounces of gum, half an ounce of sugar, half an ounce of fat, four ounces of tannic acid. Mineral matter or ash, water, and woody fiber, make up the remainder.

Caseine, of which there is so large a quantity, it will be remembered, is the nutritive principle of milk; vegetable caseine, or legumen, is analogous in principle. Tea is therefore a highly nutritious substance, and fully capable of forming flesh and sustaining life. Peas and beans are highly concentrated forms of food, and yet analysis shows that the better qualities of tea are as rich in the nitrogeneous element or nutrient principle as are these seeds. Caseine is identical in composition with the muscular fiber and with the albumen of the blood, and is easy of assimilation.

In preparing the infusion, but little of the caseine is dissolved, and also but a small amount of tannin; therefore we throw away in the infused leaves these two preponderating principles. A cup of tea holds in solution the theine, volatile oil, sugar, and small portions of the tannin, gum, and caseine. Why should we not consume the infused leaves as food? We might do so, and secure a large amount of nourishment; but the presence of so much insoluble tannin would produce astringent effects of an unpleasant character. Remove this and exhausted tea leaves might at once be regarded as a valuable dietary article.

In preparing a cup of tea, we employ water heated to nearly or quite the boiling point, as experience has proved this temperature to be necessary to dissolve out the principles desired. The peculiar solvent powers of water are wonderful, not only when considered in connection with tea leaves, but all other substances upon which it exerts specific action. Its solvent powers are wisely controlled and limited, and its physical and chemical relations to all substances, organic and inorganic, are marvelously adjusted. But, however strongly tempted to enlarge upon this point, we can only call attention to its effect upon tea. Its power over tea leaves is limited, and it can dislodge and hold in solution only such principles as are necessary to form the beverage in the highest perfection. Suppose it was capable of dissolving all the tannin, the infusion would be more in place in the vats of the tanner than upon the tea table. However nourishing and healthful is the caseine or gluten, it would, probably, if the whole amount were present in tea, impair its flavor, and interfere with its charactiristic appearance and effects. The adjustment of its solvent powers upon tea is probably perfect, when the condition under which it acts are understood and adhered to. It is capable by long-continued boiling, in connection with tea, of extracting an undue proportion of tannin, and thereby rendering the infusion unpleasantly astringent; but no amount of boiling will render one half of the whole quantity soluble.

No chemical substance can be added to tea to improve its flavor or general healthfulness. Some of the alkaline carbonates, like soda, aid the water in dissolving the caseine, but its addition spoils the tea.

If the soil and the conditions of our climate were favorable