

This view has been amply borne out in all the contests which have occurred between the French and Prussians up to the time when these remarks are made. It has been proved that the French temperament, by its impetuosity, its mobility, its desire to be doing something, has proved itself very much at a disadvantage in all that concerns the successful management of a military breech-loading small arm. Even in the old days of muzzle-loading, the great difficulty in action was to supply cartridges with due rapidity, many instances having occurred in which soldiers have had to elect between injudicious bayonet charges or absolute retreat, merely because their ammunition had given out. This being the fact, it always seemed to us that two of the very advantages claimed by the French for the Chassepot over the needle-gun, namely, its longer range and its greater rapidity of delivering fire, might turn out absolute disadvantages in the field. So far as events have gone, and can be accurately taken count of, this has absolutely seemed to have been the case. At the battle of Forbach groups of French infantry were seen making their way in disorder to the rear, merely because their ammunition had been all fired away; and subsequently, at Wörth, McMahon complained that his infantry had not been able to keep themselves supplied with ammunition in the contest.

Coming next to the mitrailleuse, it does seem wholly inexplicable, and not more inexplicable than ridiculous, that the French should have affected so much mystery in respect to a weapon that, whether good, bad, or indifferent, presents such obvious indications of constructive points to be carried out into practice and which could have been executed in many different ways. The French Emperor, as most of us know, once wrote a folio book on artillery and fire-arms generally. His Majesty has ever since manifested a certain amateur predilection for this branch of the service; but it, as would appear from published accounts, he has had anything to do with placing the mitrailleuse in the rank of an artillery instead of an infantry weapon, then we think his inspirations have led him very much astray. In some respects an instrument on the principle of the mitrailleuse has important functions and capabilities—perhaps we should rather say it is a machine that makes important promises, but we should have imagined that some of the most obvious considerations of what modern field artillery is expected to do would have led mitrailleuse constructors to determine its place as an infantry weapon from the first. By infantry weapon we mean that, although necessitating a service of its own, the mitrailleuse, its genius and construction regarded, should emulate small arms rather than artillery if it would hope to give a good account of itself. In the present day field artillery is not worthy the name if it does not embrace, or has not the faculty of embracing, shell practice. Obviously no mitrailleuse, light enough to take part in field evolutions, could be endowed with that faculty to any but a limited extent. Weight and cumbersomeness would be against it if made large enough for shell practice, and even were increased weight no longer a consideration, it would still be undesirable to project shell in such a salvo from such a machine. We English have, no doubt, placed the mitrailleuse in its true prospective rank. Recent experiments at Shoeburyness have proved that it can advance no pretensions to rank as an artillery weapon; that it is specially an infantry weapon; and, further, that to be effective the mitrailleuse should be able to employ the ordinary small-arm service cartridge, of whatever description that may be. Here we must observe that the ordinary compound cartridge of the British service—the Boxer cartridge—does not appear to answer well for mitrailleuse purposes.

Relative to the barrel construction of the mitrailleuse, we have heard even mechanics wonder why the expedient of aggregating thirty-seven hexagonal barrels in a circumscribing case of wrought iron is resorted to, when, as seems to them, the much more simple expedient of boring thirty-seven barrels out of a block of steel is at hand. If a mechanic, clever as he may be, would only try his hand at making a mitrailleuse in such fashion, his eyes might, perhaps, be opened and his opinion might alter. Some years ago Sir Joseph Whitworth, relying on accurate machinery, thought he could make double-barreled fowling pieces by boring two holes out of an elongated steel block. He found himself mistaken, as anybody would find himself mistaken who should make a similar attempt.—*The Engineer*.

THE TRAINING OF PRUSSIAN AND FRENCH SOLDIERS.

BY ARCHIBALD MACLAREN, OF THE OXFORD GYMNASIUM.

The Prussian soldier's period of service is so short (three years) that every agent to hasten his efficiency must be seized; and it has been found necessary to provide means, in the shape of large buildings resembling riding-schools, in which drill may be carried on throughout the year. And as this gymnastic system is viewed but as drill, aims but in being drill, it is, in winter, carried on in these buildings; the few articles of apparatus employed, for the sake of the advantages which they specially offer to the soldier, being erected in a corner of them. And this continuity of practice increases manifold whatever good it can yield; and thus, meager and inadequate as it is, its fruits are valuable. It is found that no other form of drill so rapidly converts the recruit into the trained soldier, and the greatest importance is attached to its extension throughout the army.

There is a general impression that this system forms the basis of the French. It would be difficult to make a greater mistake; for not only have they, either in principle or practice, nothing in common, but in many respects they are the very antitheses of each other. So far from the boasted "simplicity" of the Prussian system, and the desire to limit it to "a few exercises to be executed with great precision," being adopted by the French, they have elaborated their system to

such an extent that it is difficult to say where it begins or where it ends, or to tell what it does, but what it does not embrace. For quite apart, and in addition to an extended range of exercises with and without apparatus, it embraces all defensive exercises, with bayonet and sword, stick, foil, fist, and foot, swimming, dancing, and singing, reading, writing, and arithmetic, if not the use of the globes. The soldier is taught to throw bullets and bars of iron; he is taught to walk on stilts and on pegs of wood driven into the ground; he is taught to push, to pull, and to wrestle; and although the boxing which he is taught will never enable him to hit an adversary, he is taught manfully to hit himself, first on the right breast, then on the left, and then on both together, with both hands at once; and last, but not least, he is taught to kick himself behind, of which performance I have seen Monsieur as proud as if he were ignominiously expelling an invader from the *sot sacré* of La Belle France. Now I know no particular reason why a soldier should not be taught all these acquirements; and I know many important reasons why he should be taught some of them; but it would be difficult to assign any reason, either important or particular, why they should be called gymnastics, or be included in a system of bodily training.

The fundamental idea of the French system is sound, for it embodies that of preparation and application; it is primarily divided into two parts—*Exercices Elémentaires* and *Exercices d'Application*. The first of these, designed to be a preparation and prelude to the instruction and practice on the fixed apparatus, begin with a long series of exercises of movement and position, *propres à l'assouplissement*. What is this all-important process of *assouplissement*—this idea, shared at home as well as abroad, by civilian as well as soldier, of the necessity of suppling a man before strengthening him? What is it to supple a man? What parts of him are affected by the process and what change do they undergo? It would be very desirable to have these questions answered, because want of suppleness is a common subject of complaint, and though often caused by apparently different processes has really but one origin.

To ascertain the full meaning of a word or phrase, it is sometimes useful first to ascertain its opposite or antithesis; and the opposite of to be *supple* is, I think, to be *stiff*. If any one is in doubt as to what that means, let him take a day's ride on a hired hack along a country road, or, for the space of a working day, perch himself upon an office stool, and the results will be identical and indubitable—stiffness in the column of the body and in the lower limbs. And why? Because each and every part so affected has been employed in a manner out of accordance with its natural laws. The joints, which are made for motion, which retain their power of motion only by frequent motion, have been held motionless. The muscles, which move the joints by the contraction and relaxation of their fibers, have been subjected to an unvaried preservation of the one state or the other—the muscles of the trunk in unremitting contraction, those of the limbs in effortless relaxation. Now, one of the most important of the laws which govern muscular action is, that it shall be exerted but for a limited continuous space, and that, unless the relaxation of the muscles shortly follows upon their contraction, fatigue will arise as readily, and to as great an extent, from want of this necessary interruption to contraction as from extent of effort. And, strictly speaking, this stiffness, both in trunk and limbs, although arising from two opposite states of muscular employment, results from the same cause, *i.e.*, exhaustion; each has had one only of the two essential conditions of muscular action, that one being therefore in excess. The stiffness in the trunk of the body is caused by the ceaseless contraction of the muscles, and this state is not conducive to the rapid local circulation indispensable to the reproduction of the force expended. The opposite phase of stiffness, arising from continuous muscular relaxation, is the immediate result of causes which may be called negative—the non-requirement of nervous stimulus, the non-employment of muscular effort, entailing subdued local circulation.

The second cause of this stiffness in the trunk of the body and limbs is, that the joints have been held motionless. Viewing the joints in the familiar light of hinges, we know that when these are left unused and unoiled for any length of time, they grate, and crack, and move stiffly; and the hinges of the human body do just the same thing, and from the same cause; and they not only require frequent oiling to enable them to move easily; but they are foiled every time they are put in motion, and when they are put in motion only; the membrane which secretes this oil, and pours it forth over the opposing surfaces of the bones and the overlying ligaments, is stimulated to activity only by the motion of the joint itself.

But, it may be argued, stiffness may arise from extreme physical exertion, which has embraced both conditions of muscular action, with frequent motion of the joints, stiffness such as a man may experience after a day of unwonted exercise. The stiffness in this case, also, is simply temporary local exhaustion of power from extreme effort; the demand suddenly made has been greater than the power to supply—the waste greater than the renewal.

Stiffness, therefore, appears to be, first, a want of contractile power in the muscles which move the joints; and, secondly, a want of power in the joints to be moved. It may be temporary stiffness, arising from exhaustion of the parts by extreme or unnatural action, as in the illustrations just given; or it may be permanent stiffness, arising from weakness of the parts, caused by insufficient or unsuitable exercise; but the nature of both is identical. It is lack of functional ability in the parts affected.

To supple a man therefore is, first, to increase the contractile power of his muscles; and secondly, to increase the mobility of his joints. And as the latter are moved by the former—

can only be moved by the former—all application for this purpose is made through them.

Now, even although mere movements and positions were altogether adequate materially to develop the muscular system—materially to add to its contractile power, there is a still greater drawback than mere insufficiency in their effect upon the joints; and that is, in the danger of straining, and otherwise weakening the inelastic ligamentary bindings. For every effort of mere position has the simple and sole effect of stretching that which, from its organic structure, object, and place in the human body, is not stretchable—is not intended to yield.

To recapitulate: All exercises of mere position act directly on the joints, instead of acting on them through the muscles. Such exercise is, therefore, addressed to the wrong part of the body; it is addressed to the joint, when it should be addressed to that which moves the joint. It is the old and exploded treatment of an abnormal physical condition—subduing the symptoms instead of waging war with the cause.

The other exercises in this first division of the French system—even if they were valuable, even if they were capable of being classified under any distinct head, or arranged in any progressive order, or admitted of graduated instruction and practice—are entirely out of place here, because from their nature they court and incite to inordinate effort. It needs no argument to prove the inconsistency of directing that men, sitting or standing, hand to hand, or foot to foot, singly or in batches, shall strain and strive against men, lift cannon-shot and hold them out at arm's length "as long as possible," or sling them to their feet to cast them to a distance "as far as possible," before they are allowed to put hand or foot on an ordinary ladder inclined against a wall, or to walk along a plank raised a foot or two from the ground. It needs no argument to show that this is reversing the order of exercise when measured by the amount of effort required for its performance.

The second division of the system, consisting of applied or practical exercises (*Exercices d'Application*), embraces a very extended series, to be executed on a wide range of apparatus; and it may be broadly stated that all these exercises are valuable in either an elementary or a practical aspect—that is, either as they are calculated to cultivate the physical resources of the man, or as they may be applied to the professional duties of the soldier. I repeat, that the exercises of this division of the system are intrinsically valuable in one or other of these aspects; but it must ever be viewed as a grave error, that, so far from the special aspect of each being designated, so far from their being separated and grouped, each under its proper head, they are all retained under one head, under the single designation of "Practical Gymnastics."

The evil which naturally and inevitably springs from this want of arrangement, is the undue importance which it gives to all exercises of a merely practically useful character above those whose object is the training and strengthening of the body. This is emphatically the case in the earlier stages of the practice, where the whole attention of the instructor should be devoted to the giving, and the whole effort of the learner should be devoted to the acquiring of bodily power. Increase the physical resources first, and the useful application will follow as a matter of course. A pair of strong limbs will walk north as well as south, up hill as well as down dale—the point is to get the strong limbs.

Let not this principle of classification be undervalued. The question of "What's the good of it when I've done it?" is one not unheard in the gymnasium, and one not always easy to answer; and even could you be at all times ready with a physiological explanation of motive, process, and result, your questioner is not always a man who could understand it, and the difficulty is increased manifold when the exercise questioned has place among others of the practical value of which there can be no question. But such classification gives at once the answer: "It is of no use at all as a thing acquired; but if you should never do it or see it done again in all your life to come, it has served its purpose; for *you* are altered, *you* are improved, *you* are strengthened, by the act and effort of learning it."

But men, so intelligent as those who are intrusted with the administration of the French system, have perceived the propriety of a special application of the exercises practiced at the close of the course of instruction. And, therefore, to the *bonâ fide* exercises of the system are added certain practices in which the men are employed in "storming works, and in undergoing an examination of their general proficiency."—*Herald of Health*.

CANADIAN INVENTORS IN THE UNITED STATES.—We, says the *Canadian Pharmaceutical Journal*, notice that under the recently amended Patent Law of the United States, Canadian inventors, in common with other foreigners, are allowed to apply for patents on the same terms as citizens of the United States. The *SCIENTIFIC AMERICAN* thinks the example worthy to be followed by the Government of the Dominion. We heartily agree with our cotemporary, and hope that our law givers will fall in with reciprocity—at least as far as genius is concerned.

IN 1866, Prussia conquered Austria in six weeks. It is almost incredible that she should have repeated the same thing on France in 1870—the latter supposed to be the strongest military power in Europe.

THE production of Lake Superior copper ore this year is estimated at one million tons, which is twice as much as was produced in the entire United States in 1843.

L. I. Trueg's Heliorama.

The instrument herewith illustrated has been appropriately styled the "*Heliorama*." We shall confine our description to giving, as well as we may, the scope and uses of the instrument without going into the minute details of its construction, or discussing at length the rationale of its operation. The latter will be sufficiently apparent to those familiar with astronomy and the construction of astronomical instruments; while to those unfamiliar with the science it would be hardly possible to give, in the limited space to which we are confined, a complete exposition of the principles upon which the instrument is based.

Its name signifies the spectacle of the sun, the application of which to this instrument implies that by its use the appar-

may be made, if deemed necessary, by subtracting that number of minutes in the graduation of the arc, on C, so that ninety degrees are marked at a real distance from 0° of 89° 11'.

The second instrument of the heliorama is the hemerophora, which is an improved sun-dial. It shows not only the correct sun time but also the mean time—that is, the time which a correct clock shows.

In construction (Fig. 2) it is an inverted helioclisis, for that arc which there casts the shadow is here inverted in order to receive it, while that arc which there receives the shadow, being inverted, is here made to cast the shadow. The deviation of the sun time from the clock time, is corrected by an apparatus which moves the arc that receives the shadow,

It will be observed that the construction of this instrument is very simple, and those familiar with the instruments heretofore used to effect the same purposes, will understand its adaptation to the ends proposed.

The inventor wishes to dispose of a part or the whole of his patent, which was patented, through the Scientific American Patent Agency, December 28, 1869, and March 8, 1870 Address Ludwig Ignatius Trueg, St. Vincents, Westmoreland county, Pa., or publishers of the "Patent Star," 119 Milk street, Boston, Mass.

A Mystery in Lawrence, Mass.

A correspondent from Lawrence, Mass., sends us an account of a singular thing which is exciting the curiosity and the

Fig. 1

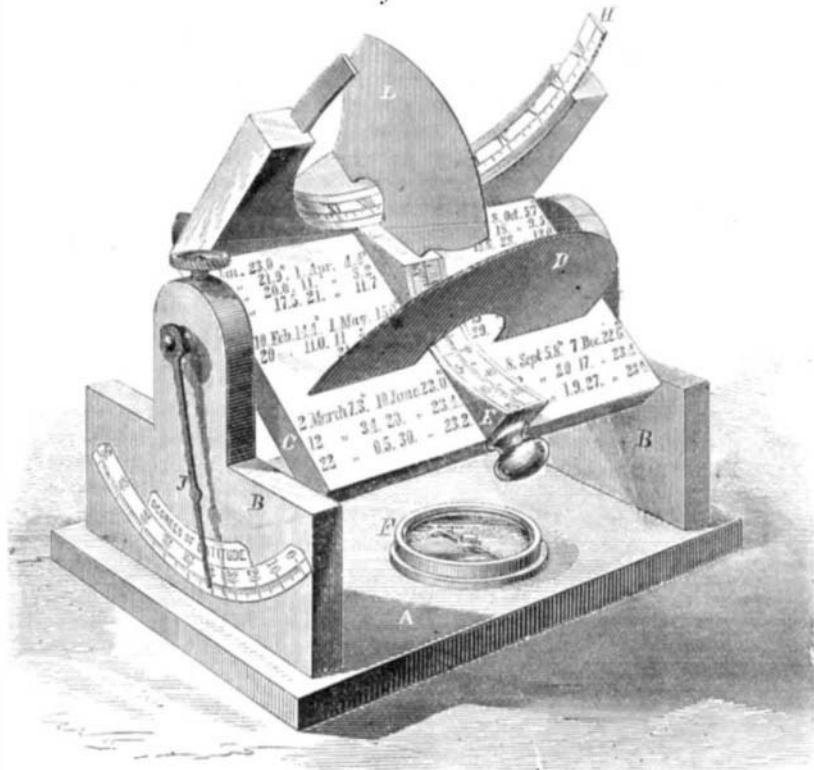
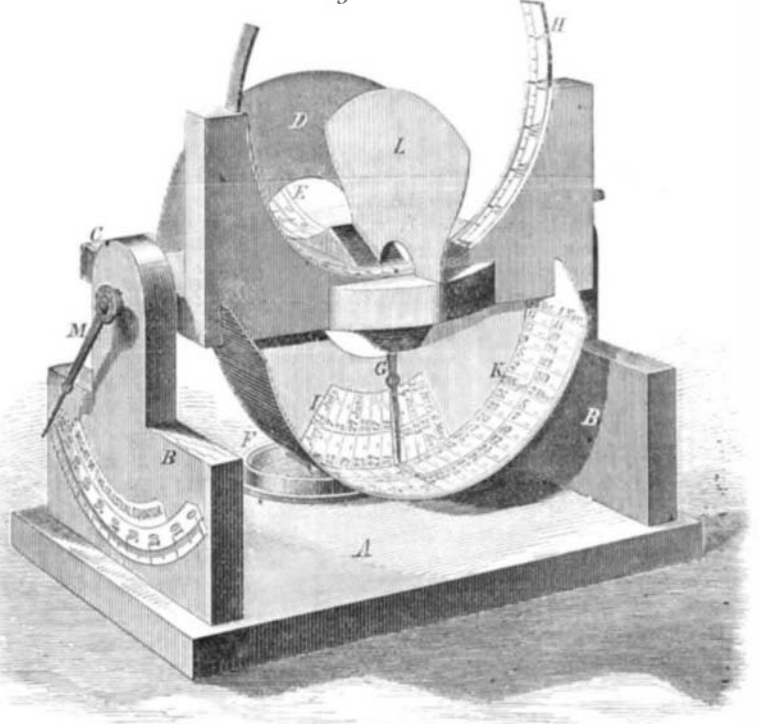


Fig. 2

**TRUEG'S HELIORAMA.**

ent relations of the positions of the sun and earth to each other may be determined, and the latitude of any given point upon the earth, and its true time by sun, or its true time by clock, may be deduced from these relations.

It may be considered as compounded of two distinct instruments, one called the "*Helioclisis*," by which latitude is determined, and the "*Hemerophora*," by which the time is determined.

It is well known that the instruments hitherto used for the determination of latitude from solar observations by seamen and astronomers can only be used to advantage at mid-day. Observations made before or after this time only approximate the true latitude. The helioclisis does this however at any time the sun is visible between the hours of 6 o'clock in the morning and 6 o'clock in the evening; a very slight adjustment only being necessary, so that, given one minute of sunshine between these hours, the mariner may determine the latitude with precision.

A basement bed, A, Fig. 1, carries two side pieces, B, which support a revolving plate, C, on which two arcs, the one a semi-circular brass plate, D, called the "*Equatorial Gnomon*," the other, E, an arc of fifty degrees called the "*Cliseologet*," are so adjusted that the center of each touches the periphery of the other from within, their radii being equal. The equatorial gnomon stands perpendicular on the plate, its diameter touching the surface of it, and bisecting the cliseologet at right angles. The point of bisection is degree 0, from which, on both sides, degrees are counted up to 25. The plate bears a list of the declination of the sun for every tenth day throughout the whole year. When the instrument is set up the basement bed must be level, and the front directed towards the south, which purpose the compass, F, in the basement is intended to serve; then the list on the plate must be consulted. If we have, for instance, April 1st, the list tells us that on that day the sun's declination is four and four tenths degrees, the plate must be then turned until the shadow of the sun, cast by the gnomon, falls on that degree. Look at the degree of latitude marked on the side pieces, facing the west. A hand attached to the pivot of the plate, B, and moving with it, indicates that degree of latitude on which the place of observation is actually situated. At sea, the instrument will be most serviceable if kept in its proper direction (with regard to north and south) by a large magnet.

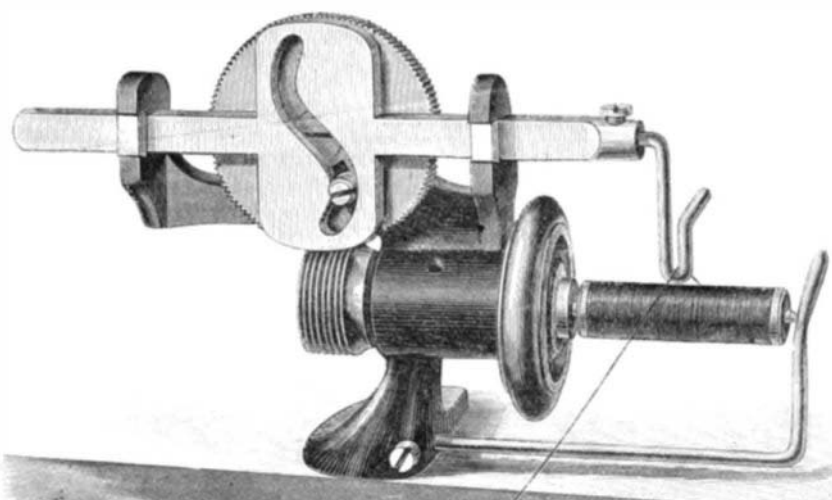
In order to make the correction for refraction, the graduation on the arc, on the side piece, C, is so made that in the distribution of degrees, thirty-three minutes of arc are lost, so that on the place where 89° 27' would come, 90° would appear. The refraction of the sun's rays corresponds to this marking, as it is at twenty degrees, twenty-one seconds; at thirty degrees, thirty-three seconds; and at ninety degrees, thirty-three minutes.

Another correction for the radius of the sun's disk, 16'

called *Horolet*, and sets it so as to show the time of a correct clock. A movable hand, G, points to the different dates of the year. No sun-dial until this has been able to show the exact sun time at every hour of the day, and at any season of the year. At any moment, when the sun shines, the hemerophora or heliorama shows what former sun-dials could only accomplish with accuracy at one moment of the day, and it indicates the mean time besides the sun time.

The arc, H, which is called the "*Horolet*," is divided regarding the hours as follows: From 6 o'clock A.M. to 6 o'clock P.M. is 180°. The intervening space is divided into 15° divisions for hours, and these divisions are subdivided into quarters. The horolet, H, is more than a semicircle, so as to gain space for the inscription of at least one hour more for the morning and one more for the evening, in order to mark time for longer than twelve hours in the summer season. This arc may moreover be shifted about its center by moving the pointer, G, so as to adjust the horolet to the time of a correct clock.

The arcs, I K, over which the pointer, G, moves, have

**AUTOMATIC BOBBIN WINDER FOR SEWING MACHINES.**

marked thereon days of the year, to which if the pointer be placed, the horolet, H, will be shifted to correspond with the time of a correct clock for that day to which the pointer is moved.

L is the gnomon, placed permanently at right angles with the horolet, as shown, and made to give correction for refraction by making the radius of its arc one thirty-second greater than that of the horolet. The effect of this is to cast the shadow backward at morning, and forward at evening, so that the shadow shall fall on the 6 o'clock mark on the horolet at precisely when the sun rises and sets at the equinoxes.

On the side piece, C, Fig. 2, is an arc which shows by the pointer, M, the height of the celestial equator at the same time that the opposite hand or pointer, Fig. 1, shows the latitude.

superstition of the good people of that thriving town. It is no less than the image of the head and a portion of a female figure lately discovered upon two adjoining panes of glass in the window of a house, and supposed by some to be the portrait of a lady who recently died in the same building. We regard the whole affair to be another hoax intended ultimately to put money in somebody's pocket. There is no doubt of the existence of the image, and the question is, How was it formed? Similar questions were put in reference to the Cardiff giant, which were satisfactorily answered in time as this perhaps will be.

Automatic Bobbin Winder for Sewing Machines.

One of the chief arguments used by the chain-stitch sewing machine interest against the double-thread machines is the trouble experienced in winding bobbins. The chain-stitch machines using thread direct from the spool do not involve this difficulty. It is the object of the invention we herewith illustrate to provide an automatic bobbin winder that shall fill the bobbins while the machine is in operation, so that all the operator has to do when a new bobbin is required is to place it in the shuttle. Each bobbin is similar to all the others when filled and the apparatus may be so adjusted that long or short bobbins may be wound with equal facility and certainty.

The simplicity of this ingenious addition to the sewing machine is such that it will be at once understood, on reference to the engraving.

The stock of the bobbin winder is screwed to the clothplate of the machine. The bobbin is placed upon a spindle, the shaft of which has upon it a small grooved pulley which rests against, and is driven by the band from the fly wheel. A worm on this spindle works in a toothed wheel. This wheel has projecting from its side a pin which works in a cam attached to the thread guide. This arrangement gives a traverse motion to the thread guide from end to end of the bobbin as the spindle revolves, thus distributing the thread evenly along its surface, and filling it much more uniformly than can be done by hand.

The cam slot is S-shaped, and the pin working therein is adjustable to and from the center of the toothed wheel, by which the traverse motion is shortened or lengthened to wind bobbins of different lengths.

These bobbin winders are made in different styles for the various shuttle machines in use, and appear to us very desirable and useful additions to such machines.

Patented, through the Scientific American Patent Agency, April 19, 1870, by Thomas Shanks, cor. Lombard and Sharp streets, Baltimore, Md., who will negotiate with manufacturers desiring to manufacture on royalty, and who may be addressed for State rights or the entire right.

WORDS are the tools with which the mind works.