two running on a cylindrical rod at the back of the machine and the third one running on a V-shaped track at the front of the machine. The carriage may be readily lifted to inspect the work by means of a carriage handle extending over the frame of the machine at the left, above the key board. When the carriage is returned to write a new line, the raising of the lever, J, brings the pawl, c, into engagement with the ratchet on the roller, B, thereby moving the paper carried by the roller forward a distance equal to the space between the letters. The carriage is provided with a simple adjustment, by means of which the space may be varied according to the requirements of the work.

In Fig. 10 is illustrated the operation of centering the type arms. An arm carrying a pin corresponding in form to the shank of the double type is supported above the ring carrying the type arms, the pin being located exactly in the center of the ring. Each lever is adjusted so that the aperture in its free extremity which receives the double type fits upon the pin. The types are adjusted in the ends of the arms in a similar way.

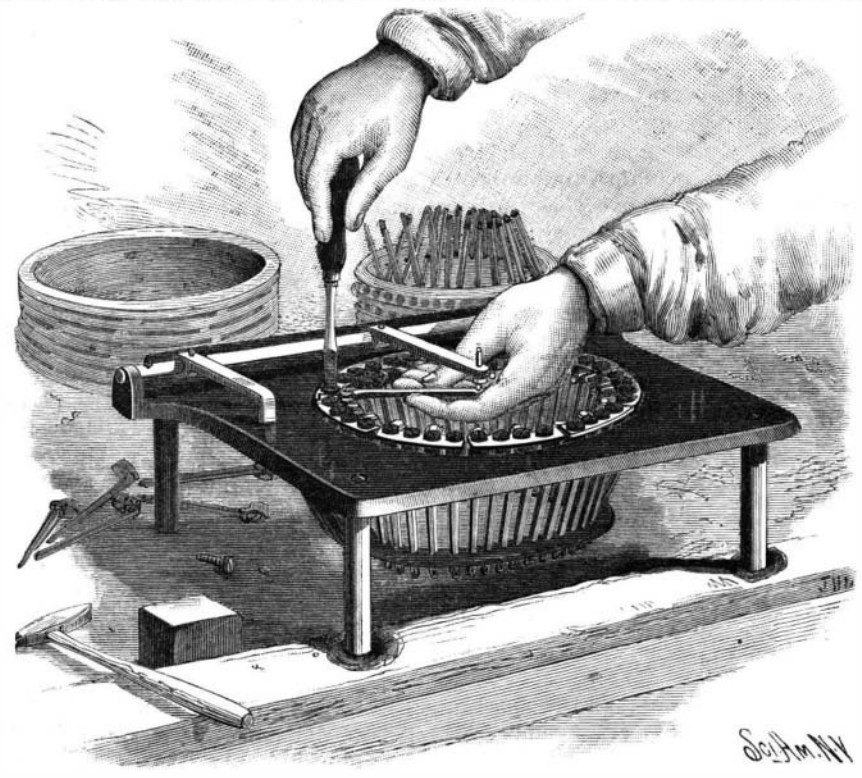


Fig. 10.—CENTERING THE TYPE ARMS.

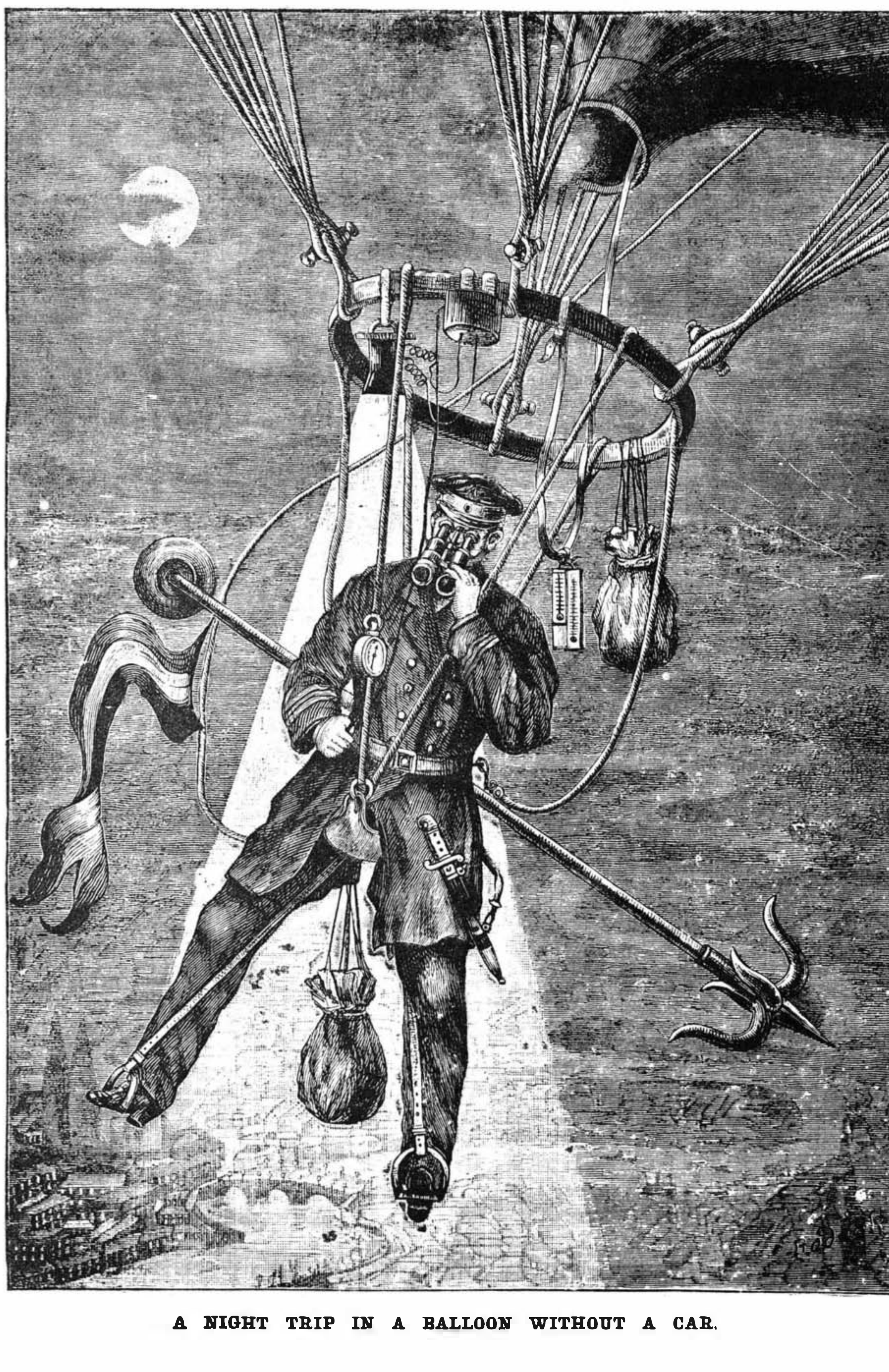
In Fig. 1 is represented the department in which the dies for making the steel types are designed and made. Great skill and much patient labor is required in the making of these dies, but when once made they are capable of producing a large number of types. Types are here formed for nearly every written language. For the Chinese no type writer has been constructed. As thirty thousand characters are employed in expressing this language, it is obviously impossible to adapt the type writer to such a large number of characters.

In Fig. 3 is shown the department for tempering, annealing, and bluing. The types used in the type writer are made of steel, tempered and hardened like wood- or iron-working tools. The workman takes a quantity of types, heats them to the proper temperature, and plunges them into a vat containing a mixture capable of giving them the required degree of hardness. To facilitate the operation of separating the types from the mixture contained in the vat, the vat is composed of an inner and outer portion, the inner portion being a sieve of sufficient fineness to retain the types while allowing the mixture to flow out as the sieve is raised.

Adjoining the type-hardening fire is the bluing furnace, in which the steel parts not otherwise protected against oxidation are blued. This operation is performed with uniformity and great rapidity by placing the screws and small parts in sand, and heating the whole until the required color appears, the sand bath being agitated to cause the heat to be uniformly distributed over the contents of the heating vessel. When the bluing operation is completed, the screws and other small parts together with the sand are emptied into a sieve which allows the sand to pass through while it retains the steel parts.

Adjoining the bluing furnace is the annealing furnace, where the types and other steel parts are softened preparatory to forcing them into dies which give them their form, before hardening.

In Fig. 2 is shown a machine in which the covers for protecting the machines are formed. In this ingenious machine the covers are quickly formed from sheet metal.



A NIGHT TRIP IN A BALLOON WITHOUT A CAR.

In addition to the various operations which we have briefly described, there are necessarily many others which go toward the completion of the machine; for example, many of the parts are nickel plated, others are japanned and nicely ornamented; many of the parts are drop-forged. The key levers are of wood ingeniously re-enforced to secure strength with a minimum of weight. All parts require special machinery to secure uniformity and perfection in their construction, which it is perhaps unnecessary to describe in this connection.

The type writer takes rank as one of the principal inventions of the age. In almost every office in every large city may be found one or more of these now indispensable machines. The SCIENTIFIC AMERICAN makes use of these machines in its editorial work, in its correspondence, and in its patent business. By its use, business has been greatly facilitated in these departments, and at the same time uniformity and accuracy have been secured.

Besides the benefits derived from the use of the type writer in business by individuals and large houses, this useful machine has furnished profitable and pleasant employment for thousands of men and women who might otherwise have been engaged in harder work at lower wages. It has proved a great educator, elevating the standard of letter and manuscript writing, often effecting the combination, in one person, of author, compositor, printer, and proof reader.

A NIGHT TRIP IN A BALLOON WITHOUT A CAR.

Public ascensions such as have been made by professional aeronauts from pleasure parks and other accessible places have been so frequent that the exhibitors can no longer expect to reap such profits from admittance fees as heretofore, and, therefore, other means of attracting the public had to be resorted to.

Many ways have been tried, among others a "trapeze artist" ascended with the aeronaut, performing his feats on a trapeze fastened to the car. But scientific men were loth to use such methods.

When aeronauts did away with the car, using instead a simple, saddle-like seat, the load carried by the balloon was greatly decreased, and consequently the balloon could be proportionately decreased in size, making its construction much less expensive and each separate ascension much cheaper, for, of course, a smaller balloon requires less gas. A saddle balloon need not have a capacity greater than 400 cubic meters, while a balloon made for carrying passengers must have a capacity of from 800 to 2,000 kilometers.

One who is fully versed in the technicalities of balloon traveling can make a journey in a so-called saddle balloon with very little more risk than in a balloon with a car, if he is physically strong, ready for all emergencies, and thoroughly practiced in his art. Of course, the saddle is less comfortable than the car. A trip in the saddle seems specially dangerous at night. Our illustration represents a night ascension made by Engineer George Rodeck, who is celebrated for his unusually hazardous voyages. In his longest trip he traveled a horizontal distance of 338 kilometers in less than four hours—an average of 84·5 kilometers per hour, a very unusual rate of speed for a balloon.

Rodeck's ball-shaped saddle balloon has a capacity of 450 cubic meters. Four strong ropes provided with swivel hooks are held on the carrier ring, hung under the balloon from the network, and these ropes carry the saddle, the aeronaut's seat. The saddle is provided with stirrups, in which the rider places his feet, so that he has three points of support. As a further safeguard, two other ropes are fastened, each by one end, to the ring, the other ends of which can be fastened to the man's belt, so that a fall from the saddle is impossible under any circumstances. In place of the usual anchor, Rodeck uses a "lance anchor" of his own invention, which he carries on his back fastened to his belt. According to his statement, the balloon can easily be held to a landing place, when the weather is not very stormy, by means of this anchor, which is handled like a spear or lance. This new arrangement has not met the approval of other aeronauts, and the writer is of the opinion that a safe landing could be made only when the air was very quiet. The sand ballast is carried in sacks hung from the ring and the saddle.

At night, even when it is moonlight, an aeronaut would not be able to read his instruments which indicate the temperature, the height, etc., and, therefore, Rodeck has constructed a special incandescent lamp, which hangs from the ring, and which can be lighted by contact whenever needed. This lamp will burn two and a half hours, and, according to the inventor's statement, weighs, with all its appurtenances, 2·5 kilogrammes.

Finally, it may be said that in all probability the saddle balloon will be used only for such ascensions as are made for public exhibition. For scientific observations and for taking bird's eye photographs it is not suitable, and it is doubtful whether it will ever be used for military purposes.—*Illustrirte Zeitung.*

Bent Wood.

We have all seen the beautiful Austrian bent wood chairs and furniture, which owe their popularity, perhaps, as much to their charming design as to their strength and durability; and most of us have had some curiosity to know how they were made. The *Revue Industrielle* explains the matter, at least so far as the processes could be observed at the industrial exhibition at Buda-Pesth. Within a few years the methods of treating the wood have been improved, and the application of the material much extended; carriage wheels, for instance, having their rims made of a single piece of ash or oak, bent to a circle, with great advantage in point of strength and cheapness over those made with fellies sawed in small sections out of straight pieces of wood. The material to be bent is, for furniture, usually red beech, which grows very abundantly in the Hungarian forests. The timber is sawed into strips one and one-half to two inches square, according to the work for which it is intended, and then turned in a lathe into smooth, round rods. These rods are placed in an air-tight case, where they are exposed for fifteen minutes to the action of superheated steam. They are then so soft and pliable as to be easily bent by hand, and are in this condition fitted to iron patterns, well secured, and left to dry. The drying takes from two to eight days, according to the size of the piece. When it is complete, the wood is detached from the pattern and is ready to be joined with other pieces, varnished, polished, and sent out in the shape of finished furniture. —*American Architect.*

Ruby Mines, Burma.

One of the finest sanitariums in India is that of Bernard-Myo, on the broad rolling plains of Enjouk, on the northern slopes of the hills bounding the ruby mining district of Mogok, Burma. Bernard-Myo is over 6,000 feet above sea level. The ruby mining district may have a population of over 6,000 people belonging to many different tribes. The mines are of three kinds: the working of fissure veins, washing in a somewhat similar manner to the hydraulic mining in California, and what may be called placer diggings. The third class of mines is at present the most important. At depths varying from ten to thirty feet, in the flatter lands of the valleys, there occurs a layer of corundum from a few inches to a few feet in thickness. When this corundum is brought to the surface myriads of small rubies glitter in the sun. Almost all the stones are water-worn or of irregular shapes, and it is rarely that a flawless ruby is found. So rare is a ruby of the finest water, that one of three carats is worth ten times the value of a diamond the same size. The district of Mogok is situated between Mandalay and Bhamo, and is nearer to the former place.

Good Cement for Sticking Porcelain on Glass.

Starch sixty parts, finely pulverized chalk one hundred parts. Mix with equal parts of water and alcohol, with the addition of thirty parts Venice turpentine, taking care to agitate the mass with a stick so as to insure its homogeneity.—*The Pottery Gazette.*

Correspondence.

How to Make Blue-Black Writing Ink.

To the Editor of the Scientific American:

Seeing many inquiries in your valuable paper about the manufacture of ink which passes from blue into black, I give you a formula below which I hope will prove satisfactory:

Tannic acid	200 grains
Gallic acid	50 grains
Protosulphate iron	1 ounce
Indigo carmine (neutral)	320 grains
Powdered cloves	5 grains
Water	1 pint

Mix the tannic and gallic acid in the water until dissolved. To this solution add iron, and filter through cotton. Then add the indigo carmine, and lastly the cloves. One good copy can be obtained from this ink.

Detroit, Mich. JOE BRESLER.

Rules for Calculating Cistern Capacities.

To the Editor of the Scientific American:

In your issue of November 24 you copy from the *Sanitary News* a table showing the number of gallons per foot in cylindrical vessels of various diameter. At the time I saw this table, I had just figured on the capacity of a cylindrical tank 5 ft. diameter by 7 ft. depth, and was chagrined to find, upon comparison, that my figures (1,028 gallons) were about 20 per cent greater than according to table mentioned. I tried several other sizes with same result, and concluded that the author of your table must have adopted for his calculations a different measure from the U. S. standard gallon, and upon reading up on gallon measure, I find that the differences between my figures and those of your table correspond exactly to the difference between the U. S. standard gallon of 231 cubic inches and that of the English gallon of 277·274 inches, from which I deduce that the *Sanitary News* is an English paper quoting English measures. This might lead some of your readers astray who like myself have frequent occasion to inquire into the capacity of cylindrical vessels.

A safe rule for finding the capacity of a cylindrical vessel is to take all the dimensions in inches, square the diameter, multiply by the depth, and then by 0·0034, which will give the contents in U. S. standard gallons. Thus, to find the capacity of a cylindrical cistern 25 feet diameter and 1 foot deep multiply:

300" × 300" × 12" × 0·0034 = 3672 (U. S. standard gallons) equal to 3,059 English gallons, the number given in your table. A. MELZER.

Evansville, Ind.

Can Animals Count the Days?

To the Editor of the Scientific American:

Working animals, such as horses and mules, are generally kept on a cotton plantation in a large open pen. In the center there is a feed shed, containing a trough for corn and a rafter for fodder overhead. Stock is fed only twice a day—noon and night. By sun-up, on work days, the plow hands appear, each to catch his "critter," and (who has not seen it?) the forty or fifty mules at their sight move in utter confusion around the shed, hiding behind one another—their exasperating protest to be caught calling forth Sambo's specific billingsgate. But how is it on Sundays? There reigns then an Arcadian peace in the pen. Each mule is paired off with his "chum" (a selective affinity, no doubt), in an angle of the rail fence. Their respective position to one another is like the "Pisces" in the almanac signs; that is, head and tail together. The object is a practical exemplification of the golden rule. To enjoy an untroubled siesta, each head secures immunity from the fly pest, by a close proximity to his friend's "perpetuum mobile." Farm hands may go in and out without producing the least sign of alarm. But, should bridles appear, that disturbs only master's saddle or carriage horses. As to the mules, no extra twitch in tail or ear shows the least suspicion that their owner could possibly be the victim of a mistake. With eyes drooping and head on a level with that of his neighbor's tail, his somnolent torpor is a picture of trust and safety. He knows it is Sunday. I remember well the amused look of my foreman, Essex, when asking him for his opinion on the subject. "Why, in course," said he, "dey knows it's Sunday."

Pertinent to the above query is the other: Do animals know noontime? For the sake of its lively scene let us, some forenoon, go out into a large field. The cotton has been "chopped out," and the bunches, left standing, need stirring with bull tongue or scadder. "Sub tegmine fagi" we watch the bucolic dance enacted by forty couples, two and four footed partners. They "chassez" up and down parallel lines, stimulating and punctuating the rhythm of motion by vigorous shouts, such as: "Jee, Solie! haw, Lisa!" The sight, however, becomes monotonous, and we drop into a pleasing speculation about the yield of the field. Presently we are startled from our reverie by an unearthly "Ee-hung, ee-hung, ee-ee-hung, hung, hung." It is the Nestor of the four-footers that calls thus: "Time for refreshments"—a signal similarly seconded and approved in succession by forty others. We look at our timepiece, and, sure enough, the large hand is about covering the smaller. It is noon. The mule (we drop the figurative), however, is some minutes ahead of time, and owing to his peculiar vindictiveness there ensues a fearful contest for the mastery between him and the driver, which the distant dinner horn only ends. It is during such a contest, when the Solies and Lisas become mulish and Sambo a mule, that the former show such marvelous contempt for the powerful jerks of the check line that their cheeks are rent by inches; in fact, there are few mules in the South that are not thus mutilated, and "sucking water" becomes quite a difficult process for them.

Now, how is it that the mule knows noontime? Does he rely on the infallibility of his timepiece, that warns him that it needs rewinding? Or has he noticed his equally hungry partner, Sambo, who, when reading the end of a row, halts a moment, and turning face northward, anxiously scans the shadow at his feet? Or is the sensitiveness of his back so delicate that he can discriminate between oblique and vertical rays?

We are prone to mystify, and because we are unwilling to grant brute creation the power of reasoning, we call their actions that surprise us "instinct." In the barn yard, stable, and field we never observe this quality of instinct in the young. It is only the old that become wise by experience. Every farmer knows that a mischievous sow, sheep, mule, horse, and cow spoil the morals of their kind, and if he knows his business, he will get rid of them.

The subject is an interesting one, and I should be delighted, for one, if some more of your correspondents would take it up and tell us what they know of our domestic animals. ADOLPH DREYSPRING.

Sing Sing, N. Y.

The Melograph and the Melotrope.

At the recent meeting of the American Institute of Electrical Engineers in this city, a pair of new instruments for the recording and reproduction of musical performances were exhibited. They are the invention of Mr. B. Abdank, a man of remarkable scientific attainments and peculiar genius in respect to mechanics. The new devices were described by Mr. Hering as follows:

The melograph is an apparatus for recording what has been played on the piano, and the melotrope is an instrument for reproducing this music from the record made by the melograph. The melograph consists of a system of contact points or keys, which are fastened under the keyboard of a piano, and are so arranged that when a key is depressed the contact is closed. These keys are then connected to an instrument like the ordinary Morse ink recorder, so that when each key is depressed the mark will be made on a strip of paper corresponding in position to the position of the note on the piano, and as each note is represented by a key and by corresponding recording apparatus, each note will, on being played, be recorded on a strip of white paper like this, in the form of a dark line which, perhaps, you can see. This paper is, therefore, a record of the notes that have been played by the player. It not only records the notes that were played, but the length of the line records the time during which that note has been held, so that it is not only a record of the note itself, but of the time of the note. This record is then passed through an intermediate apparatus called a perforator, the object of which is to perforate a piece of stiff paper with rectangular perforations corresponding to these lines of the melograph record. This is done by means of an electric apparatus which consists of a little square punch, which travels up and down very rapidly. It is driven by an electric motor. I understand the lines on this paper are first run over with a puncturing pin. Then this paper is passed over a series of contacts. Whenever the paper is punctured, connection will be made, which connection will work this little punch at a place corresponding exactly to the place of this line on this record. In other words, this record on stiff paper is an exact counterpart of the other, only that it is perforated with smooth rectangular holes, whereas this is, originally, merely a written record. This record is then ready for the melotrope—the reproducing apparatus.

The melotrope is merely mechanical in its operation, and is intended, as far as possible, to imitate the motion of the fingers in playing upon the keys of the instrument. The melotrope is provided with a long roller, which extends over the keyboard of the instrument that is to be played. The roller is provided with a series of grooves, in which are strings, which connect with little fingers, and these press upon the keys of the piano. On turning the cylinder, the fingers will be depressed and strike the keys. There are intermediate devices which cannot be properly explained without diagrams.

By means of these inventions the composer, by the act of playing, records his notes, and may subsequently reproduce their sounds by mechanical aid.