clearness and simplicity—two conditions that are very difficult to fulfill here.

Here, then, is our dynamite powder in a receptacle called a "vasque." It is carried to special rooms where the women shown in our various figures calibrate it by hand or with a machine. If they work by hand, they content themselves (as may be seen in Fig. 4) with ramming the oily powder, by means of a wooden rod, into moulds fixed to the bottom of a zinc pan. After the powder is calibrated, it is covered with paper and is ready to be packed.

More curious and much more employed is the mechanical method. Two of our engravings show a group

Fig. 7.—FILLING CARTRIDGES WITH EXPLOSIVE GUM.

of women, "cartouchieres" as they are called in the works, occupied in the manufacture of cartridges of the terrible substance. The machine, which is screwed to a wall, is of the most rudimentary description. A lever, maneuvered by the woman to the right, gives a to and fro, upward and downward motion to a bronze rod (everything is of bronze and not of iron here, in order to prevent rapid heating through friction), and compresses into a cylinder of definite caliber (from 8-10 of an inch to 1 inch) the dynamite powder contained in a leather funnel that is shown in the figure. The woman to the left breaks the roll of calibrated dynamite when she finds it of sufficient length (2¾ to 3¼ inches), and passes it to the cartridge maker situated in the center, who covers it with parchment paper in order to protect it from dampness. The cartridge is then entirely finished. Fig. 6 represents the operatives grouped around the same machine, and occupied in the final closing of the wrapped cartridges. Fig. 7 shows the filling of cartridges of the same length and diameter with what is called "explosive gum," which is composed exclusively of pure nitro-glycerine and nitrated cotton, forming a plastic paste of gum whose high explosive power is utilized for crushing the hardest rocks and for submarine blasting.

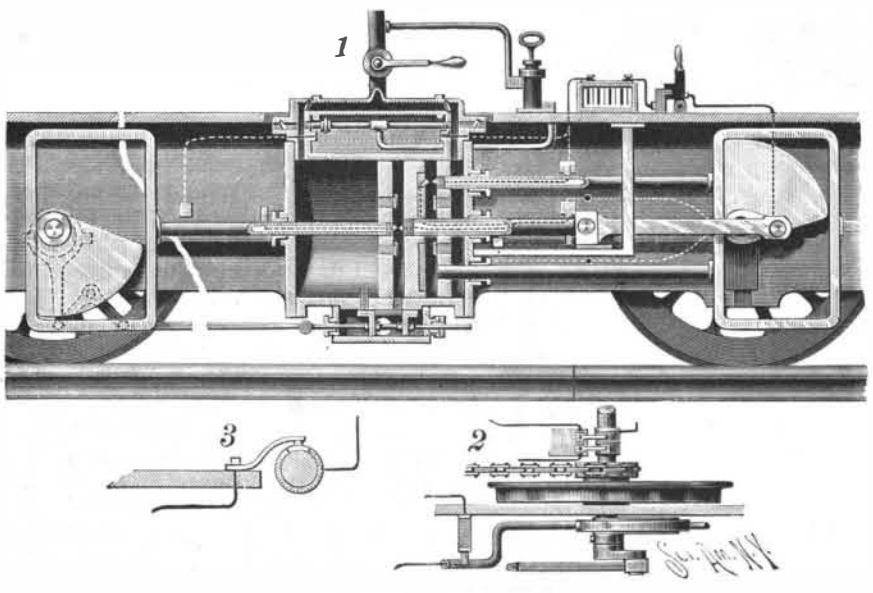
This machine might well be compared to the one used for making sausages. The gummy explosive material is accumulated in the hopper to the right. The winch to the left is turned, and the cartridges make their exit in pairs from the cylinders to the extreme right. Between the bottom of the hopper and these cylinders there is a bronze spiral that carries the substance forward and causes it to direct itself out of the machine. An operative receives the cartridges upon their exit, wraps them in paper and closes the two extremities. These cartridges are afterward carried to the packing room and put into cases, as we have already said.

It now remains for me to tell you the composition of the famous nitro-glycerine, which, up the present, seems to be, as it is in fact, the explosive constituent of what is called dynamite (from the Greek δυναμις, power). If you will refer to our engravings, you will find very faithfully represented therein the industrial manufacture of this mysterious nitro-glycerine.

The huge cylinder (which is of lead) that you see in our first figure contains the terrible mixture of nitric and sulphuric acids and glycerine, the chemical reacrion of which forms nitro-glycerine. The array of pipes that end at the cylinder, or empty themselves at the top, are the ones that lead each of these constituents to the interior of the apparatus, or that conduct the water designed to cool the mixture in order to prevent explosions due to ill-timed elevations of the temperature. In Fig. 2, a workman is placidly collecting the oily and explosive liquid, a glassful of which would suffice to blow him to atoms. This valuable and sometimes criminal liquid is carried to the room represented in Fig. 3, where it is mixed with a silicious powder. It is then kneaded until the nitro-glycerine is absorbed by the powder. . . . The paste thus formed is that which we have just seen put into cartridges, which are afterward sent to the magazines, whence they are shipped to the industries.—*Maxime Vuillaume, in L'Illustration.*

AN IMPROVED GAS ENGINE.

This engine has a double-acting piston adapted to take in the combustible mixture and compress it on either side of the power piston, there being an electric ignitor for igniting the combustible charge. The improvement has been patented by Mr. John S. Biggar, Whitesborough, Cal. Fig. 1 is a side sectional elevation, Fig. 2 shows a plan view of a portion of the engine, and Fig. 3 shows one of the contact springs. On opposite sides of the power piston are pistons drawing in the combustible mixture, one such piston being connected by a tubular piston rod with a rectangular frame acted on by a quadrant cam on one of the drive wheel axles, while the other piston has two piston rods, one of which is tubular, the rods passing through stuffing boxes in the cylinder head, and being connected with a rectangular frame which incloses a quadrant cam secured to the other drive wheel axle. At the top of the cylinder is a valve chest, with gas and air passages, and a gas pump, and in the under side of the cylinder are ports covered by a valve chest in which is a double exhaust valve to open and close the ports alternately, the rod of the valve being connected with an eccentric rod embracing the eccentric on one of the drive wheel axles. On the frame of the engine is located a battery, one pole of which is connected with contact plates, while the other pole is connected with a switch. When it is desired to start the engine from a state of rest, gas is drawn by the pump from the supply pipe and forced into the cylinder, already containing sufficient air to form an explosive mixture, and the charge is ignited by the automatic making and breaking of electrical contacts. The charge having been exploded, and the power piston forced to the extremity of its stroke, the auxiliary piston is made to follow it by the quadrant cam on one of the drive wheel axles, thereby drawing in the combustible mixture, which is thus compressed before explosion, the operations proceeding alternately on opposite sides of the piston. To cause the axles of the drive wheels to rotate together, they are connected by an endless chain running over sprocket wheels on the axles.



BIGGAR'S GAS LOCOMOTIVE.

Candy Without Cooking.

To make a delicious candy, break the white of one egg into a large, flat dish. In one end of the dish put about one pound of the very best confectioners' sugar, carefully sifted. Beat the egg, taking up a little of the sugar at a time and beating steadily for about ten minutes. Before all the sugar is in add a large teaspoonful of some preferred extract, vanilla, lemon, or rose, the first being most generally liked. Beat or stir until the sugar is all in. When done it should stand up in a firm lump and should settle but very little if left standing. Then dust a little fine sugar on a pastry board, cut off with a sharp knife a part of the beaten sugar, lay it on the board and roll it under the hands until perfectly soft and smooth, then make into a roll about as large as a 25 cent silver piece, cut off little round cakes of this about half an inch thick, pat this between the hands until very smooth, then place the half of an English walnut on the prepared pat of sugar and press it a little to bring the two in close contact. Have ready a plate rubbed over with a bit of buttered paper. On this place the candies as fast as made.

They may be set in the oven for a minute or on a shelf above the fire. Many persons put them on buttered paper, but they sometimes stick and tear the paper which adheres to them, and which is objectionable when the confection is eaten.

Sugar prepared in this way may be used to coat fruit or nut confections of various sorts. Blanched almonds are rolled in little cakes of it, care being taken to press and roll the sugar so that the nut is entirely covered. Various sorts of nuts chopped fine may be mixed in with the sugar or fruits, such as citron shredded, seeded raisins cut up fine or candied, or preserved fruits of any sort, care being taken that they are not too juicy, as this would prevent hardening.

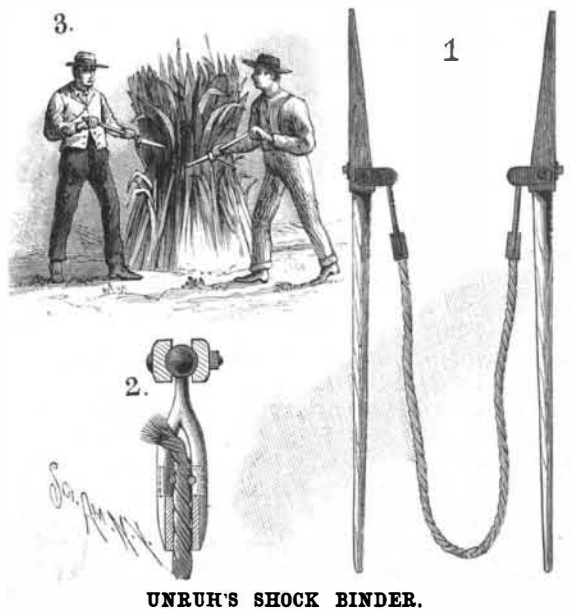
Fresh fruits may be put up in this way. If grapes are dipped in the beaten white of an egg and allowed

Fig. 8.—PACKING AND BOXING THE CARTRIDGES.

to dry, then rolled in this same beaten sugar, they are delicious. Sometimes the confection is made quite soft, then placed in a hot oven for a moment and allowed to remain until thoroughly scalded through, care being taken that it is not browned. In this way it gets the elastic, firm quality so much liked in what are called French confections.—*N. Y. Ledger.*

AN IMPROVED SHOCK BINDER.

The device shown in the illustration is designed to facilitate the binding of corn shocks quickly and tightly, in order that they may be readily tied. It has been patented by Mr. Charles S. Unruh, of Steele City, Neb. As shown in Fig. 1, two levers are employed, a socket being fastened by a bolt on the inner face of each lever, and each socket having a circular recess to receive a ball formed on the shank of a clip, as shown in Fig. 2. The body of the clip is tubular, and immediately above the body of the clip each side face of the shank is engaged by a tie plate, the two tie plates being connected by bolts, provided with suitable nuts. The binding section of the device consists of a rope whose ends are passed through the tubular bodies of the clips, where they are held by tightening the tie plates. When the device is operated by two men, each engages the lever with one side of the shock, and draws the rope around, as shown in Fig. 3, the shock being tied by means of binding twine, after the stalks have been drawn as closely together as possible. The device may, however, be



UNRUH'S SHOCK BINDER.

operated by one man, the ball and socket connection between the clips and the levers permitting the latter to be carried in almost any direction without twisting or unduly kinking the rope.

THE auger that bores a square hole consists of a screw auger in a square tube, the corners of which are sharpened from within, and as the auger advances, pressure on the tube cuts the round hole square.

How to Cure a Cold.

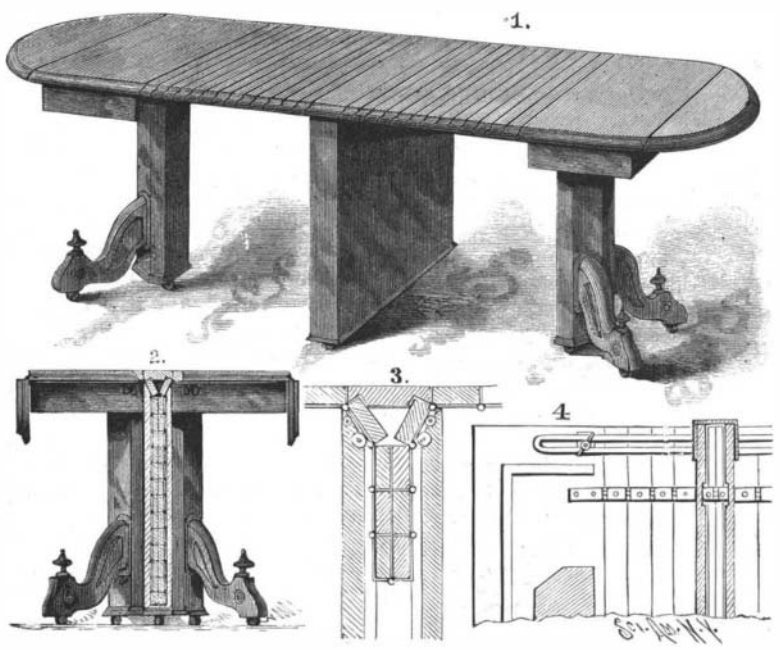
Almost everybody has a remedy for a cold, which he is ever ready to recommend to others after detailing his own experience.

The Boston *Journal of Commerce* quotes from a medical writer some advice on this subject which seems to be more than ordinarily useful.

When one becomes chilled, or takes cold, the mouths of myriads of little sweat glands are suddenly closed, and the impurities which should pass off through the skin are forced back at the interior of the body, vitiating the blood and putting extra work on the lungs and other internal organs. Just beneath the surface of the skin, all over the body, there is a network of minute blood vessels, finer than the finest lace. When one is chilled, the blood is forced from these capillary vessels into one or more of the internal organs, producing inflammation or congestion, and thus often causing diseases dangerous to life. The time to treat a cold is at the earliest possible moment after you have taken it. And your prime object should be to restore the perspiration and the capillary circulation. As soon, then, as you feel that you have taken cold have a good fire in your bedroom. Put your feet into hot water as hot as can be borne, and containing a tablespoonful of mustard. Have it in a vessel so deep that the water will come up well toward the knees. Throw a blanket over the whole to prevent rapid evaporation and cooling. In from five to ten minutes take the feet out, wipe them dry, and get into a bed on which there are two extra blankets. Just before or after getting into bed drink a large glass of lemonade as hot as possible, or a glass of hot water containing a teaspoonful of cream of tartar, with a little sugar if desired. Should there be a pain in the chest, side or back, indicating pleurisy or pneumonia, dip a small towel in cold water and wring it as dry as possible. Fold the towel so that it will cover a little more surface than is affected by the pain. Cover this with a piece of flannel, and both with oiled silk, or better, with oiled linen; now wind a strip of flannel a foot wide several times around the chest. The heat of the body will warm the towel almost immediately, the oiled linen and flannel will retain the heat and moisture, and, steaming the part, will generally cause the pain to disappear. Should there be pain or soreness in the throat, you should treat in a similar manner with wet compress and flannel bandage. Eat sparingly of plain, simple food. Baked apples and other fruit, bread and butter, bread and milk, milk toast, baked potatoes or raw oysters may be eaten. By following the above directions intelligently and faithfully you will ordinarily check the progress of the cold, and prevent serious, possibly fatal, illness.

AN IMPROVED EXTENSION TABLE.

The table shown in the illustration has been patented by Julius S. Graaff and I. M. Harbaugh, of Portland, Oregon, and the improvement has also been patented in Great Britain, France, and Germany. The rigid end sections of the table top are connected by narrow hinged leaves, forming a continuous hinge, or the leaves may be held together by rubber bands, belting, or other suitable material and these leaves are adapted to double down in a box, cabinet or skeleton frame at the center of the table as shown in Figs. 2 and 3. The box is provided with vertical side recesses to receive the hinges, and with anti-friction rollers, enabling the leaves to be easily moved. At opposite sides of the box, near the top, are angle braces, the upper arms of which extend outwardly beneath the table top, giving a full and substantial support thereto, and slide within the rigid portions at the ends when the table is closed, as shown in Fig. 2. As shown in the partial view of the under side of the table top, Fig. 4, the arms of said braces are slotted, and adapted to be engaged by thumb screws turning in nuts in the rigid end portions of the table, the screws being tightened to hold the parts in fixed position, either open or closed. The space between the opposite leaves when they dip down into the box is closed by a cover strip having recesses on its under side to fit over the tilting upper leaves, as shown in Figs. 1, 2, and 3. By attaching extra boxes, cabinets, or frames for the reception of additional hinged leaves, the length of the table may be still further extended, and the improvement may be readily applied to an ordinary table. When the table is to be used where space is limited, the box may be attached to the wall and connected with one end portion of a table, which is then extended from the wall by simply pulling it out into the room, the table in its closed position being convenient for use as a desk, shelf, etc. The leaves sliding in the box may also be arranged in independent series, the opposite sides not being hinged together, and with this arrangement one end of the table may be drawn out without disturbing the other end. Simplicity and cheapness, as well as novelty, ornament, portability, strength, and lightness of construction are claimed for this improvement. All correspondence relative to the same should be addressed to Graaff & Harbaugh, 203 Morrison Street, Portland, Oregon.



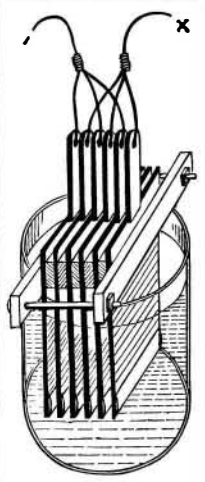
GRAAFF & HARBAUGH'S AUTOMATIC EXTENSION TABLE.

STORAGE CELLS FOR AMATEURS.

C. L. WOOLLEY.

In the construction of storage cells on a small scale, the method of using uncoated lead plates merely roughened, afterward depending upon the forming process to create active material on the surface, gives good results, save that the forming process is exceedingly tedious.

Plates coated with a paste of red lead give better results and that in a very much shorter time. The amateur, however, is usually beset by many difficulties in the matter of the coating of the plates, the paste, no matter how well dried, having a tendency to fall off so soon as the plates are immersed in the acid solution in the cells. The writer has, by means of a simple process which he has already touched upon in a letter on storage batteries, published in the SCIENTIFIC AMERICAN a year or more ago, succeeded in preparing storage cells that have given for various experimental and domestic purposes exceedingly good results, during a period of a year or more, and are still in use. The plates, of any convenient size, may be either cast in wooden or iron moulds or cut from sheet lead; they should be sufficiently thick—⅛ inch or more—to withstand possible bending or buckling as much as possible. A strip of sheet lead 4 or 5 inches long should be soldered to the top of each plate, from the upper end of which soldered copper connections may proceed. The copper is thus removed from the danger of corrosion from acid spray. Holes having a diameter of about one-half inch should be punched in each plate at regular intervals. The balance of both sides of each plate should be thoroughly roughened, either by drawing the tang of a file repeatedly across in various directions or by the use of a punch with a roughened face. For coating the plates a stiff paste should be mixed of powdered red lead made up with a mixture of water 2 parts, sulphuric acid 1 part. The plates are to be thoroughly coated on both sides, and the holes in the plates well filled up. Each plate is then, while paste is moist, wrapped tightly in one or two layers of coarse muslin, and this is bound down firmly in place with cotton cord, passing around the plates at short intervals. The use of the cloth cover-



STORAGE CELLS FOR AMATEURS.

ings makes success possible. The paste is held in position until, by the process of forming in the cells, it becomes sufficiently hard and adherent to remain in position on the plates, when, if they have not already been rotted off by the acid, the cloths may be removed.

The number of plates in a cell may be from a single pair to an indefinite number. Connections are made to alternate plates, one connection proceeding to plates Nos. 1, 3, 5, 7, etc., the other connection to plates Nos. 2, 4, 6, 8, etc.

When not more than six or eight plates in each cell are used, a convenient method of holding them in place is shown above. A series of wooden insulating strips are made, each being thoroughly baked and soaked in hot paraffine. Two heavier wooden bars on either side of the row of plates, drawn together at the ends by bolts, serve to hold the plates in position, each plate being separated from the one next to it by one of the insulating strips. The wooden bars should also be well soaked in paraffine. The bars are of such length that they extend across the top of the cell and sustain the row of plates and prevent their touching the bottom of the cell. A single cell when charged will give two volts. Each additional cell arranged in *series* will add 2 volts, as 4, 6, 8, etc. The charging current may be from a small dynamo or a primary battery, in which case a gravity or blue vitriol is to be preferred.

The E. M. F. of charging current must exceed the sum of the storage cells by at least 10 per cent. For example, three cells gravity will charge a single cell of storage, five or six will charge two cells storage, eight or nine will charge three cells of storage, and so on.

The storage cells may be used very satisfactorily for operating small lamps, small fan or sewing machine motors, etc.

The first charging of a new storage cell is best accomplished by a series of bichromate cells, as Fuller or carbon, after which the gravities will charge very well. It will be found that up to a certain point the capacity of the storage cells will increase with each charge and discharge. The solution in the cells in which the plates are immersed is composed of water, 9 parts, sulphuric acid (commercial), 1 part. After forming, always charge in the same direction and always discharge the cells through some form of resistance.

Solidified Chloroform.

A new discovery is described in the *Berichte* which is likely to throw some light upon the vexed and important question of chloroform and its impurities. Professor Anschutz, of Bonn, in the course of certain researches in which the preparation of salicylic anhydride ($C_6H_4CO_2$) was involved, had occasion to use chloroform in the process, when he found that the mixed solution after being left for some time deposited in beautiful crystalline form a compound of chloroform with salicylic anhydride. A similar compound is formed also when ortho-cresotinic acid is substituted for the salicylide. The salicylide contains about 33 per cent of chloroform and the cresotinic compound about 30 per cent. Both bodies yield very pure chloroform when heated to 100° C.—a temperature considerably below their melting points. The cresotinic compound is, however, the more stable body, decomposing but little in the air, while the salicylide, under the same conditions, slowly gives off chloroform in a state of remarkable purity. Inasmuch as none of the usual impurities of chloroform crystallize along with these compounds, the process would appear to afford a method for the purification of chloroform on more satisfactory lines, for repeated crystallization is a method which yields, as every chemist knows, the purest and most refined products. Moreover, a solid chloroform compound is, as will be imagined, less likely to undergo decomposition than a liquid compound, while the advantage of being able to transport chloroform practically in a solid form (for by simply warming the compound pure chloroform may be obtained) is one of obvious value. Meanwhile, the results of clinical experiment with this new product will be awaited with eager interest—this being the test that alone can decide its value for anæsthetic purposes, however "chemically pure" the substance may be.—*Lancet.*

Oil vs. Coal.

The question of whether an oil operator has a right to drill through coal which has been leased previously, to reach oil or gas below, is one which has been the basis of a number of suits, and the lower courts in this State have decided that the owner of the surface has such right. The Chartiers Block Coal Company determined to test the decision and carried its case to the Supreme Court of Pennsylvania. Chief Justice Paxson has handed down his decision in the case, sustaining the finding of the lower court. Judge Paxson reviews the case, and after stating that the rights of the oil operator to reach his possessions are inalienable, says: "The grantee of the coal owns the coal but nothing else, save the right of access to it and right to take it away. When the coal is all removed the estate ends and the space it occupied reverts to grantor by operation of law. The owner of the coal must so enjoy his own rights as not to interfere with the lawful exercise of the rights of others, who may own the estate either above or below him. The surface owner has a right to reach his estate below the coal at all times. If we sustain the company, it will leave the owner of the surface at the absolute mercy of the owners of the coal. For these reasons we will not disturb the decree of the court below. The appellant company has its remedy at law, and to that we will remit it. The decree is affirmed, and the appeal dismissed at the cost of appellant."