A SIMPLE BALANCE.

The want of an inexpensive balance, sensitive enough to weigh very small quantities of matter accurately, frequently makes it impossible for those of slender means to engage in assaying or any quantitative chemical work. The simple and easily constructed contrivance described below will supply this want. With a little practice and careweighings can be made on it that will compare favorably in point of accuracy with the more elaborate and costly analytical or assay balance.

The hollow pillar, A (Fig. 1), is made of strips of perfectly dry, light wood, three-eighths of an inch thick, two inches in width, and twenty-eight inches in length, smooth finished inside and out, and joined at the edges and secured with screws. It is firmly fixed in a perpendicular position on the heavy wooden base, B, by mortising. The square wooden rod, C, thirty inches long, is planed and smoothly finished so as to snugly fit and slide easily in the hollow pillar, the screw, D, serving to hold it securely in any position.

A strip of good plate glass mirror, two inches wide and twenty-eight inches long, is secured in position against the face, F, of the pillar, A, by small brass bands at top and bottom. The slide, *b*, of thin, hard brass, one inch wide and three and a half inches long, is bent so as to slightly pinch the sides of the pillar and be moved easily up and down before the mirror. A spring, *a*, of fine hard brass wire is suspended before the mirror from a brass pin or screw, E. From the bottom of this spring is suspended a slender wire three inches in length, in the middle of which is fastened a small white bead, *c*. A scale pan, one and a half inches diameter, preferably of nickel-plated brass, is attached to the end of the wire. The base, *b*, may be secured by screws to a table. The mirror surface should be as nearly perpendicular as possible.

The method of using the balance is as follows: The substance to be weighed is placed in the scale pan, and the rod, C, is drawn up until the tension of the spring is sufficient to suspend the pan with its load before the mirror. As soon as the vibrations cease the eye is brought on a line with the top of the white bead, *c*, and its reflection in the mirror, as in Fig. 2. The slide, *b*, is then moved up until its upper edge just touches the line of vision between the bead and its reflection without disturbing the slide, *b*, the substance is then transferred from the scale pan, and small standardized weights put into its place until sufficient weight has been introduced to bring the bead again fairly on a line with the edge of slide and reflected bead. The weights in the pan correspond to the weight of the substance.

Fig 1

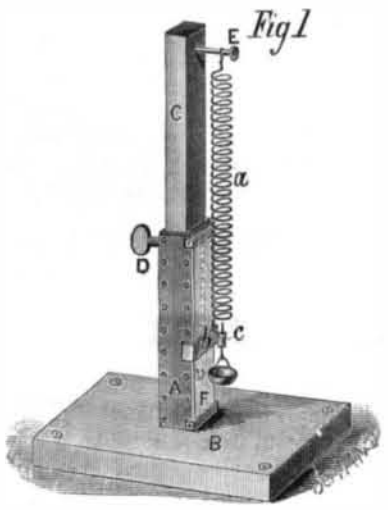
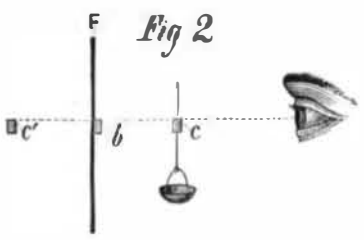


Fig 2



If the spring is gently handled in changing the substance for the weights no appreciable change takes place in its tension, but to avoid any chance error it is best to return the substance to the pan after the weights have been removed, and note if the bead returns to the first position marked by the slide.

In making these weighings the weights should be put into the pan as soon as the substance is removed, and *vice versa*, no interval being allowed.

This balance is not intended to weigh a greater quantity of any substance than thirty grains, though with stronger wire spring it can be made to weigh ounces nearly if not quite as accurately as an ordinary balance. The rod, C, can be made to move smoothly if it sticks by rubbing it with a little powdered talc or soapstone.

CRYSTALLINE ALBUMEN IN PUMPKIN SEEDS.—Pumpkin seeds contain an albumen which may be easily obtained in well developed octahedral crystals. The proteine contained in the seeds consists chiefly of such crystals. Crystalline albumen is distinguished from the amorphous variety by a far smaller proportion of ash and of phosphoric acid, and by higher proportion of carbon, nitrogen, and sulphur.

VENTILATED BATH BOX FOR CHEMICAL AND PHOTOGRAPHIC PURPOSES.

Every photographer knows or ought to know the exceedingly poisonous character of the fumes rising from the cyanide of potassium bath used in fixing photographic negatives and ferrotypes. These fumes are nothing more nor less than prussic acid, the most subtle and deadly poison known. Usually the poison is so diluted with air as to be very slow in its operation. Nevertheless it acts continually

MACURDY'S VENTILATED BATH BOX.

on the operator, gradually undermining his health, producing premature decline. The engraving shows a compact and efficient device for avoiding all this by inclosing the cyanide bath in a small box provided with a ventilating tube communicating with the external atmosphere.

The box is provided with glass sides, one of them forming a door which can be opened or closed at pleasure. When open it forms a hood, which prevents the fumes from escaping into the room, while it admits of viewing the plate as it lies in the bath.

The invention will be readily understood by reference to the engraving, and it will be appreciated by all photographers. It is a thing that has been needed, and should meet the approval of every operator.

Further information may be obtained by addressing the inventor, Mr. J. C. Macurdy, P. O. box 426, Boonville, Mo.

CONDENSED MILK.

In answer to a number of correspondents who have asked how condensed milk is prepared we give the following:

When the milk is brought into the factory it is carefully strained, placed in cans or pails, which are put into a tank of water kept hot by steam coils. When hot it is transferred to larger steam heated open vessels and quickly brought to a boil. This preliminary heating and boiling has for its object the expulsion of the gases of the milk, which would cause it to foam in the vacuum pan and, also to add to the keeping quality of the milk by destroying the mould germs. A second straining follows, after which the milk is transferred to a vacuum pan, where, at a temperature below 160° Fah., it boils and is rapidly concentrated to any degree desired. The vacuum pan employed is a close vessel of copper, egg-shaped, about six feet high and four and one-half feet in diameter. It is heated by steam coils within, and by a steam jacket without—inclosing the lower portion. In one side of the dome is a small window through which gas illuminates the interior, while on the opposite side is an eye-glass through which the condition of the contents may be observed. The pan is also provided with a vacuum gauge and test sticks. Much of the milk used in cities is simply concentrated without any addition of sugar. The process of concentration is continued in the vacuum pan until one gallon of the milk has been reduced to a little less than a quart—one volume of condensed milk corresponding to about four and three-tenths volumes of milk. The following table of analyses by Dr. Waller shows the composition of several brands of this condensed milk sold in New York city:

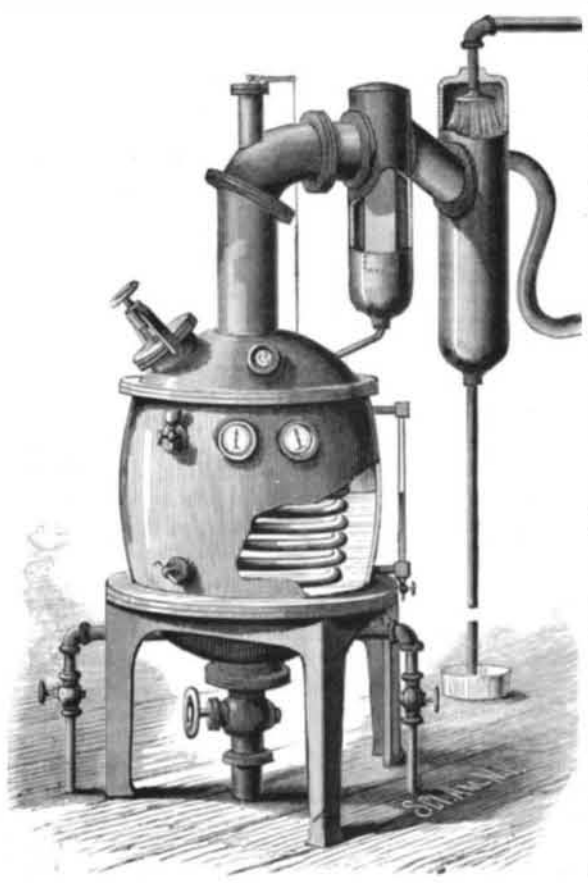
	American.	Eagle.	New York.	National.
Fat	16·29	14·36	14·28	13·97
Casein	17·26	15·07	13·96	14·02
Sugar	10·64	11·64	13·90	10·44
Salts	2·77	2·10	2·00	2·33
Water	53·04	56·83	55·86	59·24
	100·00	100·00	100·00	100·00

The average composition of fresh cow's milk is as follows:

Fat	3·799
Casein (and albumen)	4·369
Sugar	4·543
Salts	0·635
Water	86·660

Condensed milk intended to be preserved for any length of time has an addition of pure cane sugar made to it during the boiling, and is usually put up in sealed cans. This sugared or "preserved" milk, when properly prepared, will keep for many years. The following analysis of this "preserved" milk will serve to indicate its composition:

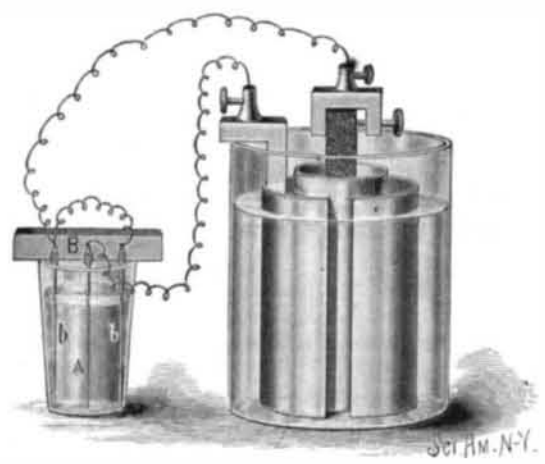
Fat	9·55
Casein (and albumen)	10·26
Milk sugar and cane sugar	53 34
Salts	1 91
Water	25·94



VACUUM PAN FOR CONDENSING MILK.

ELECTRO-ASSAY OF COPPER ORES.

The average copper ore is difficult to assay by fire. The results, even where great care is exercised in the various manipulations, are rarely exact or trustworthy. The ordinary wet methods of analysis are rather complicated, slow, and expensive, good work requiring the facilities of a chemical laboratory.



ELECTRO-ASSAY OF COPPER ORES.

Correspondents who have asked how to test copper ores will find the following method simple, expeditious, and sufficiently accurate for all practical purposes.

The operations are, reduction of the ore to a uniform powder, sampling, decomposition and solution in acids, separation of the soluble and insoluble portions, decomposition of the dissolved copper salts, and separation of the copper by means of electricity.

A representative sample of the ore is reduced, by pounding and grinding it in an iron mortar, to a powder, the whole of which will pass through a wire gauze sieve of 100 to 120 meshes to the square inch. This powder is well mixed together, and a sample of one third ounce is taken for assay. The sample is put into a porcelain dish or cup, and enough hot water is stirred in (with a glass rod or clean slate pencil) to form a thin paste. About two ounces of strong nitric acid is then gradually added, and as soon as the first strong reaction has quieted somewhat the dish or cup is set in a pan and surrounded with hot water. The treatment with acid is best conducted out of doors, so that the abundant fumes may escape without injuring anything or poisoning the air. If too much acid is added at first the action is apt to be violent and some of the contents will be lost through spattering. The water in the pan, as it cools, should be replaced by hot water if it is not convenient to keep fire under the pan. When the disengagement of red fumes ceases, usually in the course of half an hour, the liquid portion (or as much of it as can be without disturbing the sediment) is decanted into another porcelain dish, which is placed in the water bath. More acid—an ounce or more, if required—is poured over the undissolved residue, and the dish containing it allowed to remain on the water bath another half hour. The partly evaporated acid solution, first decanted, is then carefully washed back into the dish containing the sediment with a little hot water, and the liquids allowed to evaporate to complete dryness over the hot water bath. Over the dry residue half an ounce of strong sulphuric acid is poured, cautiously, and the mixture is stirred until fumes are no longer given off. Then one ounce of cold water is stirred in, and after a few minutes' standing two ounces of