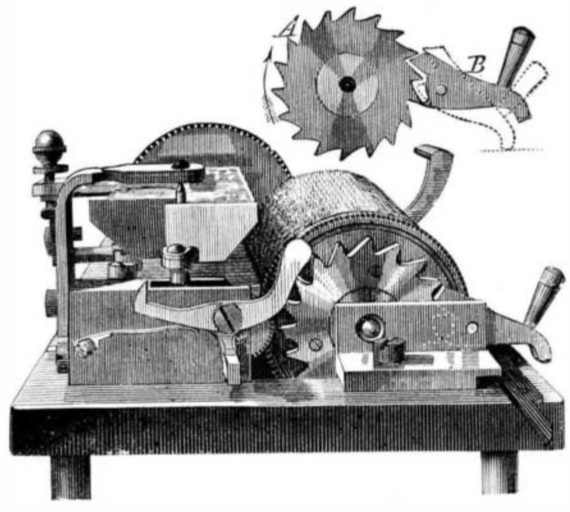
SAFETY CHECK FOR MUSICAL BOXES.

Musical boxes are operated by one or more more powerful springs, the speed being controlled and regulated by a series of wheels and pinions connected with a fly wheel. Now if the fly wheel be broken or removed, or any of the wheels get loose from the pinion when the spring is wound, the cylinder will revolve with lightning rapidity, and bend or break the pins on the cylinder as well as the teeth of the comb in such a manner as to ruin the instrument forever. In order to prevent such accidents (which occur almost daily), Mr. C. H. Jacot, of the firm of Jacot, Juillerat & Co., 37 Maiden Lane, New York city, has invented an attachment,



JACOT'S SAFETY CHECK FOR MUSICAL BOXES.

herewith illustrated, by which these accidents will be impossible, for as soon as the cylinder revolves too fast a pawl will engage in the ratchet wheel and hold it firmly. The action of the pawl is positive, and it has no chance to fail in working.

Secured rigidly to one end of the shaft of the cylinder is a ratchet wheel, A, formed as clearly shown in the engraving. Pivoted so as to engage with the teeth of this wheel is a pawl, B, having a weighted outer end; the upper part of the inner end of the pawl is formed to fit the recesses of the teeth, and the lower part is so formed that each tooth, as it moves by, will raise the outer or weighted end. This movement brings the upper inner end of the pawl into one of the recesses, but before the tooth touches it the lower part is freed from its tooth, allowing the weighted end to drop and thereby remove the upper part away from the wheel, as indicated by the dotted lines. This motion is of course made possible by the slow movement of the cylinder. But if, from any cause, the cylinder should move rapidly, the pawl would be brought into engagement with one of the teeth of the wheel, and the motion of the cylinder would be arrested. The device, as will be understood, is positive and absolutely reliable in its action, and can be placed upon any instrument without necessitating a change in the arrangement of the parts.

A New Rubber Supply.

We mentioned some time ago that a new industry was attracting attention at Rio Pardo, Minas Geraes, namely, the production of rubber from the milk of the *mangabeira*, a tree of the family of *Apocyneas* and very common there, as well as in the north of the empire. According to a letter written from the city (Rio Pardo), at first only the fruit was used, but later it was proved that the milk, very abundant in the trees, and which may be extracted in the same manner as is in use with the *Syphonia elastica*, by incisions, becomes readily converted into excellent rubber, equal if not superior to, as we are assured, that produced in the Amazonas. Further, it is stated that the preparation is very easy, for if 85 grammes of alum dissolved in 3 liters of pure water be added to 3 liters of the milk, coagulation is perfectly secured and rubber obtained, which should be exposed to the sun for a few days. The latter states that a jug (*garrafa*) of this milk sells in Rio Pardo at 200 to 250 reis, and that many people are employed in its extraction; also that the first shipment of rubber had been made to Bahia; it weighed 250 arrobas, and the result is anxiously awaited.—*Rio News.*

PETROLEUM AND ITS APPLICATION TO THE RUNNING OF LOCOMOTIVES.

The petroleum industry is, as well known, daily becoming more and more extensive. The naphthas derived from the country of the ancient Guebers of Baku, and especially from the peninsula of Apcheron in the Caspian Sea, are now being collected industrially, and seem as if they were to come into formidable competition with those of America. In fact, there are at present more than six hundred wells in operation in the Baku region, where, in 1873, there were but a few only. The annual production of naphtha, which in 1832 was 2,500 tons, rose to 28,000 in 1870, reached 410,000 in 1880, and even exceeded this figure in the first half of 1884. The wells are operated by powerful corporations, and notably by the Societe Nobel, which alone extracts half the oil that the Baku region yields, and which has applied some improved apparatus that has permitted it, so to speak, to completely transform this industry.

The naphtha deposits are concentrated around Baku in strata of Miocene marls and limestone that are peculiarly contorted, and exhibit numerous folds, which form so many reservoirs, in which the mineral oils collect. The boring of the wells presents no very great difficulty in these calcareous rocks, and, as a general thing, the wells are not driven to a greater depth than from 260 to 325 feet. The work is thus effected under more advantageous conditions than it is with American petroleums, the deposits of which are met with at a much greater depth. The yield of the wells is very variable by reason of the great irregularity of the folds of the calcareous strata, some wells being found that are perfectly dry right alongside of others from which petroleum spurts in abundance. There is even cited a well recently driven by the Societe Nobel that would have discharged 8,000 tons per 24 hours had not the necessary arrangement been made to shut off the flow and collect the oil only for a few hours during the day.

The extraction of petroleum in the Baku region is concentrated around the village of Balakhani, about nine miles distant from the town of Baku, whither the crude oil is carried in order to be distilled in the refineries situated in the suburbs. At present the carriage is effected upon a small railway constructed for the purpose; but there has also just been laid, as in America, a pipe line, in which the oil will run directly from the wells to the distilleries.

As cast iron allows carburets of hydrogen to ooze through it, the pipes, which are from 7 to 8 inches in diameter, had to be made of forged iron.

The material as it reaches the refineries is in the form of a dark brown liquid, which, upon distillation, gives products that are more or less volatile. The first product disengaged is benzine—a volatile liquid employed mostly for cleaning fabrics. Afterward comes kerosene, which gives off no vapors at the ordinary temperature. Aside from this product, the same distillation gives a yellowish petroleum called "solar oil," which is used for street lamps. The residuum of the distillation forms a heavier liquid, of medium density, called "masoute" or "astatki," which is principally used for heating the generators of the locomotives on the Baku-Tiflis line, and those of the boats on the Caspian Sea.

The use of petroleum for heating boilers presents decided advantages in certain cases, since we thus obtain a fuel which, although it is perhaps of a higher price, possesses twice the calorific power of coal, and allows us to increase the vaporization, while at the same time diminishing the charge. This is a valuable feature, as regards its application to steamboats (especially to torpedo boats), as well as to the locomotives of express trains, upon which, in fact, petroleum furnaces are often used.

Mr. Urquhardt, engineer of the Gratzi-Tsaristsin Railway (southeastern Russia), has made a specialty of this question, and has succeeded in constructing furnaces which are peculiarly well adapted for the combustion of petroleum, and by means of which he has been enabled to greatly increase the power of locomotives.

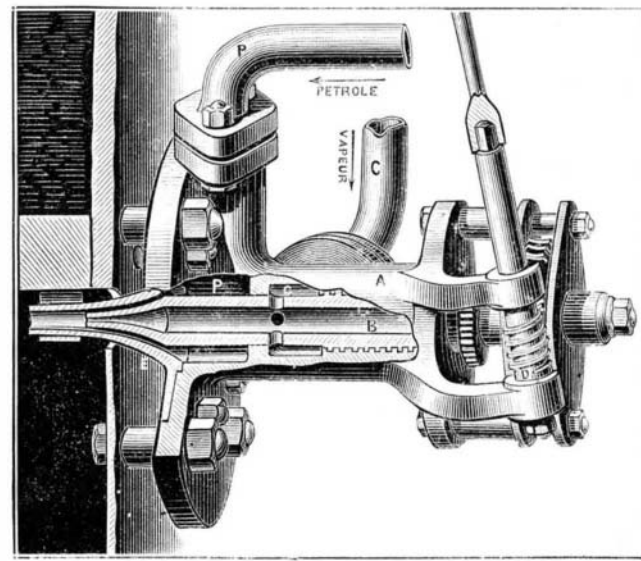


Fig. 2. PETROLEUM INJECTOR.

Figs. 1 and 2 show the latest form of the apparatus, and Fig. 1 gives the general arrangement of it upon a locomotive and tender. It will be seen that the furnace is internally provided with brick domes. These are designed to protect the metal, and, at the same time, through a combination of flues, to secure an intimate admixture of the petroleum with the sucked-in air. The petroleum is forced by a current of steam into an injector, which is shown in detail in Fig. 2, and from thence to the bottom of the furnace. Here it becomes lighted in contact with the current of sucked-in air that enters, as shown by the arrows, through a trap in front of the ash box. This air has already been heated on traversing A by coming into contact with the two masonry arches of the furnace. A portion of the flame is directed by the flues, B. to the bottom of the tube plate, which it strikes directly. An inspection of Fig. 1 will show at once how the apparatus operates. The petroleum contained in the front compartment of the tender is heated by a current of steam from the boiler that enters through the pipe, S, and after traversing the worm enters the side of the feed pipe, P.

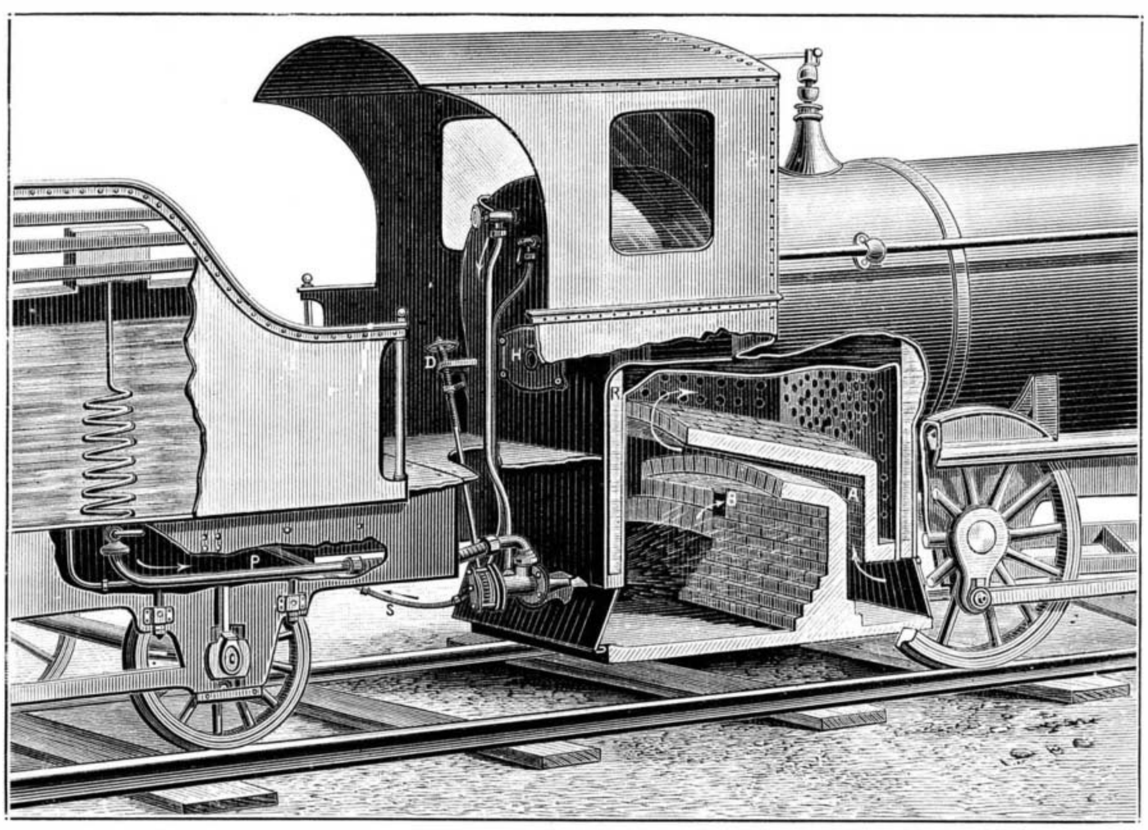


Fig. 1.—ARRANGEMENT OF A LOCOMOTIVE BURNING PETROLEUM.

On making its exit from the latter, the petroleum enters the injector, shown in section in Fig. 2, and flows around a central nozzle, B, which is traversed by steam that is coming from the boiler through the pipe, C. The mixed current that forms is disengaged, as shown in Fig. 1. In former arrangements the injector was adapted to the top of the furnace frame, and had to cover both that and the side of the fire box, thus making it more costly.

It will be seen that it is very easy to regulate the combustion from the engineman's cab by acting upon the injector through a rod, D, that terminates in an endless screw, which gears with the pinion of the nozzle and permits of opening the latter to any degree desired. In this way the combustion is regulated with as absolute certainty as could be done with gas, and all waste of fuel is avoided.

Before entering the reservoir of the tender the petroleum passes through a filter that retains foreign matters, and is again filtered upon making its exit. The arrangement of the nozzle is such, however, as to give passage to any solid matter that the current might carry along. At the bottom of the tender there is a special reservoir, in which accumulates the water that crude petroleum always carries along with it, so that the oil reaches the injector in a very pure state.

The firing up of this apparatus is effected by means of a current of steam from a neighboring boiler. The steam is directed into the vertical pipe seen back of the fire box, and following the direction shown by the arrow, reaches the injector and causes the petroleum to flow in.

Another portion of the same current is directed by a three-way cock at the orifice of the pipe into the blower conduit, and finally enters the smokestack and increases the draught. The pressure quickly rises in the boiler, and reaches three atmospheres in 45 minutes, and even eight in 20 minutes with water that is already warm.

It should be remarked that there are certain precautions to be taken in firing up, in order to prevent the explosion that might occur through the petroleum vapors already accumulated in the furnace. The injector is first blown out by a current of steam, while at the same time the doors of the ash box and the blower are opened in order to suck the vapors out of the furnace. After this there are placed therein a few rags soaked with petroleum, which are lighted in order to communicate fire to the jet that is entering from the injector. The fire thus started afterward keeps up normally without any difficulty and without there ever being any need of tightening up the escapement in order to quicken the draught, seeing that the flame meets with no obstacle to its disengagement.

The regulation, moreover, as we have just seen, is effected with the greatest ease by acting upon the rod, D, of the injector nozzle. The discharge of petroleum is estimated according to the position of the said rod in its fixed nut, and the behavior of the fire can be watched through the sight-hole, H. In a word, we have here a very clean and easily managed fuel, and one that is in certain cases more economical and more advantageous than a solid one. It produces no sparks, and does not appear to be accompanied with any danger from fire in cases of accident.—*La Nature.*

How Starch is Made.

The Indianapolis *Sentinel* describes a visit to the Franklin Starch Works of Thompson, White & Co., where so called non-chemical starch is made.

The works are located in the northeast part of the city on a ten acre lot, usually known as the Old Fair Grounds. The buildings cover three acres of ground. The main building is 150 by 200 feet, two stories high. Just south of the main building is a large crib with a capacity of 70,000 bushels of corn.

Near the east side of the main building are the large vats for the reception of the coarse feed, and a little farther southeast are the gluten vats—two in number, 16 by 200 feet, and about 4 feet deep. Near the southeast corner of the main building the corn is carried by a belt from the crib to the sheller, which has a capacity of over 1,500 bushels a day, and is run by a separate engine of forty horse power. After the corn is shelled it is carried to the "cleaner," where all the dust and dirt is removed. It is then by means of an elevator deposited in a long bin in the upper story. By means of separate spouts the corn is conveyed into fourteen large "steep tanks," holding 600 bushels each. After being covered with hot water it is allowed to remain six days, or until it is sufficiently soured. It is then by a screw conveyer and elevator taken to the millstones hopper. Just before it reaches this point it passes through a revolving wire screen, which separates the corn from the water.

It is then conveyed to the mills, four in number, being mixed again with water, and after going through two sets of four foot millstones it passes below to the "shakers." These are vibrating boxes, open at one end and covered with a wire and satin sieve. Here the starch and gluten are separated from the solid particles of the corn, which is called "coarse feed." This descends into a well, and is pumped up by means of a powerful force pump, and run off into vats for its reception, where it is drained and is ready for sale. After passing through the "shakers," the starch and gluten is conveyed to the "run house," receiving on its way a stream of water. The run house is a room 100 feet square, containing 56 troughs, about 18 inches wide and 100 feet in length. These runs are slightly inclosed, and while passing through them the starch settles to the bottom, while the watery part passes off and is run into the gluten vats. The starch is then conveyed to the agitator wells, and, being mixed with cold water, is thoroughly agitated by means of a revolving rake. It is then pumped up and passes through a bolting reel, where all the impurities are separated, and the pure starch conveyed, by means of pipes, to 63 settling tubs. The water is then drawn off, and the starch, pure and white, is conveyed to a large receptacle, where it is placed into the mould boxes.

After remaining in the mould boxes three to four hours it is cut into blocks about 6 inches square, elevated to the second floor, placed on cars, and run into the crusting room, where it remains over night. The next morning the blocks are scraped, or rather the crust cut off with sharp knives, and are wrapped in blue or bronze paper, by one person, at the rate of 800 packages per hour. These packages are placed on cars with slatted frames, holding 392 packages each. About 100 of these cars are used. As they are filled they are run into the dry room, which is kept at an average temperature of 160 degrees by means of steam pipes. The starch is kept here until it is thoroughly dried into the prismatic form in which it is purchased in the market. The cars are run to the wareroom and the packages wrapped in blue paper or packed in boxes, while those in brown paper are conveyed to the packer and packed in barrels by means of a flour packer, at the rate of 200 barrels a day.

The principal brands of starch manufactured by the Franklin Works are the "Acme," for laundry purposes, "Pure Corn" and "Powdered," for confectioners and baking powder manufacturers. All of these brands have a high standing in the market, and find ready sale in all the principal markets of the country. The machinery is all of the most approved pattern, and is, by various ingenious devices, made to do the principal part of the work. Still, about fifty men are employed when the works are in operation.

To obtain a superior quality of starch the corn must first be properly steeped, and the operator in this department must have skill and experience. To secure starch from corn in paying quantities it must be properly ground. The next important point is in the sieving. The smallest hole in the sieve will admit impure matter, which it is hard to eliminate. Again, particular attention is required in the precipitation of the starch on the inclined plane. In the dry room great attention must be paid to the temperature; too high a temperature will produce a scorch, and too low a mould.

The Synthesis of Ammonia.

Mr. G. Stillingfleet Johnson has recently published a condensed account of the proceedings of himself and others in the direction of producing ammonia from atmospheric nitrogen. Mr. Johnson has on previous occasions explained the fact that ammonia is not always obtained in the course of experiments intended for its synthetical preparation, by starting the hypothesis of a second form of elementary nitrogen, having the same relation to the ordinary form of the element as ozone has to oxygen. He is inclined to hold that this active form of nitrogen loses its power by being heated, resembling ozone in this characteristic. Like other chemists, Mr. Johnson has failed in all attempts to produce ammonia by passing atmospheric nitrogen, recently heated and then mixed with hydrogen, through red-hot tubes in presence of platinum sponge. He has, however, obtained ammonia from atmospheric nitrogen which had not been heated, by mixing it with pure hydrogen in the presence of platinum sponge.

The nitrogen was first made to pass into a glass gasholder, traversing a vessel filled with sawdust saturated with freshly precipitated ferrous sulphide. The nitrogen was then allowed to stand for some days over water holding ferrous ferrocyanide in suspension; and was afterward passed in succession through caustic potash, alkaline pyrogallate, strong sulphuric acid, and Nessler reagent. The hydrogen used was carefully purified by successively passing it through a mixture of chromic and sulphuric acids, and through Nessler reagent. The consequence was the formation of ammonia always, except when the nitrogen had been heated. The quantity of ammonia was small, never exceeding 1½ milligrammes from 10 liters of hydrogen.

The crowning experiment for the production of ammonia by direct synthesis is thus described by the author: Into an ordinary eudiometer tube, full of mercury, admit a measured quantity of pure nitrogen gas. Next introduce three times its bulk of pure hydrogen, and insert in the gaseous mixture a fragment of wood charcoal which has previously been ignited in hydrogen gas, or, better, in a mixture of three volumes of hydrogen with one volume of nitrogen. Let the spark be now passed continuously through the wires of the eudiometer. About 4 to 6 cubic centimeters of the mixture are combined and absorbed by the charcoal per hour, until the whole of the gas disappears. The charcoal will now be found impregnated with ammonia.

FORTY-FIVE models have been submitted for the statue of J. J. Rousseau, which is to be erected in Paris. M. Carrier-Belleuse, who is never stereotyped, represents the philosopher in the fields studying a flower which he holds in his hand, and several other sculptors have been inspired with a similar idea, although they may have not carried it out so well. Jean Jacques Rousseau is looked upon in England simply as an impassioned writer who was one of the forerunners of the Revolution, the "Declaration of the Rights of Man" being an abstract of his "Contrat Social." But he was also the author of a dictionary of botany, and his love of the country exercised an influence on his speculations.

PHOTOGRAPHIC NOTES.

HOW TO SENSITIZE AND TONE ALBUMENIZED PAPER.

Mr. W. B. Tyler, of San Francisco, Cal., Secretary of the Pacific Coast Amateur Photographic Association, gives the following as the method he has successfully worked: A sensitive silver bath is first made in the following proportions:

Distilled water	1 oz.
Nitrate of silver	45 gr.

The sheet of paper is floated on this for 90 seconds, then drawn off over a glass rod at one end of the bath, drained, and blotted off with blotting paper, and finally dried with heat.

The sheets are then hung up in a fuming box having a saucer containing some strong liquid ammonia placed on the bottom. After remaining in the box for 20 minutes and sometimes longer, which corrects all acidity that may have been in the bath, the paper is removed and then is ready for printing.

The paper should be printed rather deeper or darker than is customary for several toning baths, otherwise it will bleach out too much.

After using the nitrate bath it is carefully sunned, and is then decanted and filtered, perhaps once a month. The

Toning Bath

is made of:

Water	32 oz.
Chloride of gold	8 grns.
Bicarbonate of soda, quant. suff.	

to make the bath slightly alkaline when tested with red litmus paper.

A pinch of common salt is also added.

Before toning, the prints are carefully washed in three or four waters, a small quantity of acetic acid being added to the first water. The toning should be carried up to a rich purple; the prints are then washed and fixed in fresh and strong solution water and hyposulphite soda, known as the "hypo bath," for fifteen minutes.

We have seen some excellent prints made by this formula; it can be recommended as being reliable.

REDUCING GELATINE CHLORIDE PRINTS.

Messrs. Ashman & Offord relate in the *Photographic News*, their method of reducing overprinted chloride prints which have been toned and fixed, and are still very much too dark, is to put into a reducing agent composed of:

Cyanide of potassium	1 gramme.
Liquid ammonia	1 cub. cent.
Water	1 liter.

The prints should be agitated in the above solution until the desired reduction has taken place. When it is intended to reduce glass positives by this means, it will be better not to tone quite so much, since the reducer has a tendency to slightly gray the image.

ENLARGING DIRECT BY REFLECTED LIGHT.

The same gentlemen suggest the use of the gelatine chloride picture on opal glass as a medium to be copied and enlarged from.

When large-sized pictures are required from a small but satisfactory negative, it is usual to make the transparency and enlarged negative by transmitted light.

Objections to this plan have been frequently pointed out. In the gelatino-chloride process a good positive on an opal plate obtained by contact printing is first made, and this is copied direct by the camera, the image being enlarged in proportion as the camera is placed close to the picture.

The resulting enlarged negative contains all the delicate shading shown in the opal plate, without any grain.

The color of the print on the opal can be easily varied to suit the strength of the negative, and the surface can be worked up in monochrome, which does not in any way affect the enlargement, unless the latter exceeds four diameters.

City and Town Schools.

A report on the city school systems of the United States has been prepared for the Washington Bureau of Education by Dr. J. D. Philbrick. The latest accounts which are available are those of 1882, and up to that year the total expenditure on 259 cities and towns was $27,894,427. The school property was supposed to be worth $94,294,153. There are two plans proposed for promoting industrial education. One is by annexing the workshop to the school for general education, whether elementary or higher. This mode is sometimes called the putting the workshop into the school. The second is by establishing technical schools for apprentices, consisting primarily of the requisite shops, with appliances for giving the theoretical instruction applicable to the trade taught. This mode has been denominated the putting of the school into the workshop. Dr. Philbrick advocates universal evening drawing schools, evening technical instruction similar to the English science and art classes, evening technical schools after the French model, the establishment of one or more apprenticeship schools in each city, simple manual training schools for the smaller towns, and more highly organized ones in the greater cities.