communications to the agricultural profession, page 408, year 1855. The process is, 1st, Extracting the starch from the corn in the usual way; 2d, Converting the starch by diastase or malt into glucose; 3d, In another vessel converting starch into starch sugar, by aid of sulphuric acid. When sugar is formed in this way the glucose sirup is added to that boiling with sulphuric acid, to produce a more complete conversion of dextrine into grape sugar. The action of malt or diastase on starch will stop when 30 per cent of sugar is formed.—*Comptes Rendus*, December, 1861, Vol. III., page 1,217; A. Payen.

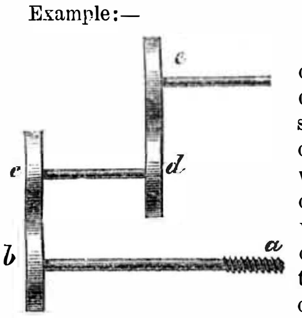
According to T. Musculus (*Comptes Rendus*, 1861,) only 33⅓ per cent of sugar is formed by the action of the diastase. T. A. HOFFMANN.

Change Gears for Lathes.

MESSRS. EDITORS:—I noticed in your issue of the 10th inst., a method of calculating the change gear of lathes, by Chas. E. Albro, of New York city. Your editorial hint to careful mechanics, at the end of the article, was well timed. Most machinists' lathes, with simple gearing, will cut just double the number of threads to the inch with the gearing mentioned in the examples of Mr. Albro.

I think Mr. Albro has overlooked the fact that most machinists' lathes, with simple gearing, are furnished with an auxiliary spindle called the change gear spindle or stud, which is generally, though not always, geared to move at half the speed of the main spindle of the lathe head. To obtain a correct solution of the problem it is necessary to take the movement of this auxiliary spindle in relation to that of the main spindle into the calculation; for instance, if, as in the case of Mr. Albro, 12 threads to the inch are wanted, and the change gear spindle moves at half the speed of the main spindle, it will only make 6 revolutions while the main spindle makes 12; consequently it must be 6 and not 12 which we multiply in order to get the correct relative proportion, or number of teeth, of the two gears required.

Example:—



Let a=the number of threads to the inch on the lead or feed screw; b=the number of teeth on the screw wheel; c=the number of teeth on the loose wheel of the stud spindle; d=the number of teeth on the fast wheel of the stud spindle; e=the number of teeth on the main spindle gear. Then the number of threads to the inch, which any change will cut is equal to $\frac{a\times b}{c\div(d\div e)}$ or $\frac{b}{c}\left(a\times\frac{d}{e}\right)$.

Let y represent the number of threads to the inch wanted, then—$\frac{c}{a}\left(y\div\frac{d}{e}\right)=b$ and $\frac{a\times b}{y\div(d\div e)}=c$

Let m represent any number used as a multiplier, then— $m\left(y\div\frac{d}{e}\right)=b$

and— $m\times a=c$

All that is necessary to calculate for fractions of threads is to convert vulgar into decimal fractions, and multiply in the same manner as you would for whole numbers. For compound gearing different equations are necessary, as the intermediate gearing has to be taken into the calculation also.

A. BUCKHAM.

Newark, N. J., December 10, 1864.

[We understand Mr. Albro's rule to refer to lathes with simple gearing only, that is *one* intermediate between the spindle and lead screw; in which case the intermediate is of no importance. Modern lathes are made as Mr. Buckham states, but there are many old-fashioned lathes for common work that have but three wheels—one on the spindle, one intermediate, and one on the lead screw.—EDS.

Advantage of Deep Raceways.

MESSRS. EDITORS:—I believe that the advantage of having raceways of considerable depth is not universally understood. Messrs. A. C. Seeley & Co., of Danbury, Conn., have a discharge raceway ninety rods long, from their water wheel to the river, eight feet deep, and ten feet wide on the bottom, and level. They use a Reynolds Water Wheel which takes 168 inches of water under 7 feet head, and the discharge raceway fills just 12 inches deep with water, when the wheel is in operation. In the winter season, experience has shown that it was a great advantage to have the raceway deep, as it kept clear of ice even in very severe weather. A. T. P.

HOW MILK IS CONDENSED.

In our last volume we published an article on Condensed Milk which gave some interesting general particulars. We find in the *Daily Tribune* some additional facts which are also interesting; we repeat for the benefit of our readers.

We will start from the platform where the cans are received from the farmer, and take the reader step by step through the whole process.

If the cans "pass muster," they are immediately emptied through a fine cloth or strainer into the receiving vat, which holds a thousand quarts. From that the milk flows through a pipe, and is drawn into brass pails which hold fifty quarts each. These stand in a flat tub capable of holding fifteen pails at once, which is filled with water that is heated by a coil of steam pipe. Here the milk is heated to 190°-195°, and in this first process of the work of condensing lies the whole secret of success. This was the discovery of Mr. Borden. He was not the originator of condensed milk. It had been thought of and processes patented before the date of his patent, but all had failed, because the albumen of the milk, if boiled in open kettles, burnt upon the bottom, and if *in vacuo*, coated the pipes and vessels, preventing perfect condensation, and, if heated too high, giving an unpleasant odor to the condensed milk. When thus cooked upon the inside of the condenser, the albumen became an insoluble cement, which required great labor to remove, and which, if not removed, would spoil the next charge.

In this water bath, in these open pails, the albumen is coagulated, without separation from the watery portion of the milk, and a little portion that adheres to the pail is almost instantly removed by placing the pail bottom upward over a steam jet, instantly followed by a strong water jet, in the same way that the farmers' cans are so perfectly cleansed. Until this plan was adopted, the work of cleaning off the coagulated albumen was very laborious. Now it is almost instantaneous.

This first process requires but a few minutes, and two men stand ready to hook a tackle to the pails as fast as the contents reach the proper temperature, and hoist them out of the bath and empty them through a fine brass wire gauze sieve into what is termed a "steam well." This is a copper vessel shaped like an egg, standing on end, with about one-fourth of the upper end cut off. This holds about seven hundred and fifty quarts—six and a quarter barrels. This well is made with a steam jacket over the lower end, so that the milk, which is already heated almost to the boiling point, is soon brought to that degree, and is then ready to go to the condenser.

The first boiling in the open kettle appears to be another of the requisites in the preparation for the final operation, as it gets rid of something in the milk that tends to make it foam in the boiler; and if there is any defect in the condition of the milk, it is exhibited here in this open kettle, and the deposit of albumen that takes place during the first boiling is easily seen and cleared off between the changes. There are two of these steam wells, with their accompanying water baths and receiving platforms. From these the milk is taken by what is generally termed suction, through tinned iron pipes, to the floor above where there are three condensers, or vacuum pans. These in form are somewhat like the steam well, the egg shape being complete—being four or five feet diameter, and holding one thousand quarts. In the upper part on one side, there is a window, through which strong sunlight, or lamplight, is reflected to the bottom, and opposite this there is an eye-glass, through which all the movements of the milk are seen, and by that means the boiling is regulated. There is also a manhole, through which a man enters after each charge is withdrawn, and scrubs the copper bright enough to almost see his face in it. The lid of the manhole being screwed on, the pan is to ready commence receiving a charge. The first operation is to start a powerful double-action air-pump, which exhausts the air in the vacuum pan until the gage shows twenty to twenty-five inches.

The cock in the pipe connected with the steam well is now opened, and the milk rushes up to fill the vacuum. This pipe, by the by, is inserted into the milk from the top, and does not extend quite to the bottom, so that if any sedimentary matter has accumulated there from the boiling, it is not taken up to the condenser. As soon as the first charge is drawn up, more milk is prepared ready in the well for the next demand. The steam is now let on, heating the coil of pipe inside, and the steam jacket outside of the condenser, the pumps being kept in continual operation, and the milk closely observed by the intelligent Yankee girl (one of the "mudsills"), who has charge of the pan, and prides herself in keeping it and all around as neat as she does her person, and all are faultless. In a few minutes she observes the thermometer indicate 190° and that the milk *in vacuo* is boiling rapidly. In open air at this elevation it would require 210°, and could not have eighty per cent of the water it contained removed, as is the case in the condenser.

As the boiling goes on, the milk continues to flow in, until 3,200 quarts have been taken up. Then the cock of the supply pipe is closed, and from this time the most watchful care of the attendant is required to keep the heat regular, and the pumps working perfectly. The pumps stand upon the lower floor, where a stream of cold water flows upon the air chamber, and condenses the steam vapor drawn from the boiling milk into water, which is discharged into a stream constantly flowing through the building. This condensed vapor constantly emits that peculiar odor that we perceive in milk warm from the cow, or during the operation of boiling, and which contains the germ of putrefaction. When the charge of 3,200 quarts shows by the gage that it has been reduced to 800 quarts, it is ready for the final operation of purification. The steam is shut off, and its place filled with cold water, the effect of which is to condense the vapor in the air-tight pan, and thus diminish the pressure. This increases evaporation, and the effect is to throw off all the remaining odor, through the discharge of the pumps. This often has such a fetid, sickening smell, that it pervades the atmosphere all around, and affords one of the most convincing proofs of the value of the process that discharges such a substance from our daily food.

From the time the milk is received from the wagons until it is finished in the condenser, about three and a half hours are required for all the operations. It is then drawn into ordinary milk cans, and these are placed in an ice bath in the lower room, and require an hour and a half to become perfectly cold. It is now ready for shipment to the city. In summer time it is kept icy cold by means of an "ice core," that is a tin tube filled with ice, inserted in the cans, occupying about one-fourth of the space. Ordinarily, the milk drawn from the cows night and morning is condensed during the day and shipped at night, and delivered to city customers the next morning at thirty-two cents a quart.

It is a very curious fact that although only four quarts are condensed to one, when pure water is added to reduce the article again to milk, it is invariably found that it requires four quarts of water, and that the milk is then better than what is really pure milk, as drawn from the cows, and far better than much that is sold as pure milk.

THE PNEUMATIC LOOM.—Mr. T. Page, C. E., reports on a new system of weaving by compressed air in the pneumatic loom. The improvement will affect the working of nearly 500,000 power-looms, the labor of more than 775,000 persons and the manufacture of about 1,200,000,000 lbs. of cotton alone. The principle upon which the new loom acts is that of discharging a jet of compressed air from the valves of the shuttle-box, upon the end of the shuttle, at each pick or stroke, and thus substituting for the imperfect motion of the "picker" the pneumatic principle, simply applied. The working velocities will be in proportion of 240 strokes by the new machine per minute, to 180 strokes of the old in the same time. This improvement applied to the whole of the power-looms of the United Kingdom would represent a total increase of 1,400,000,000 yards over the produce of the same number of machines.

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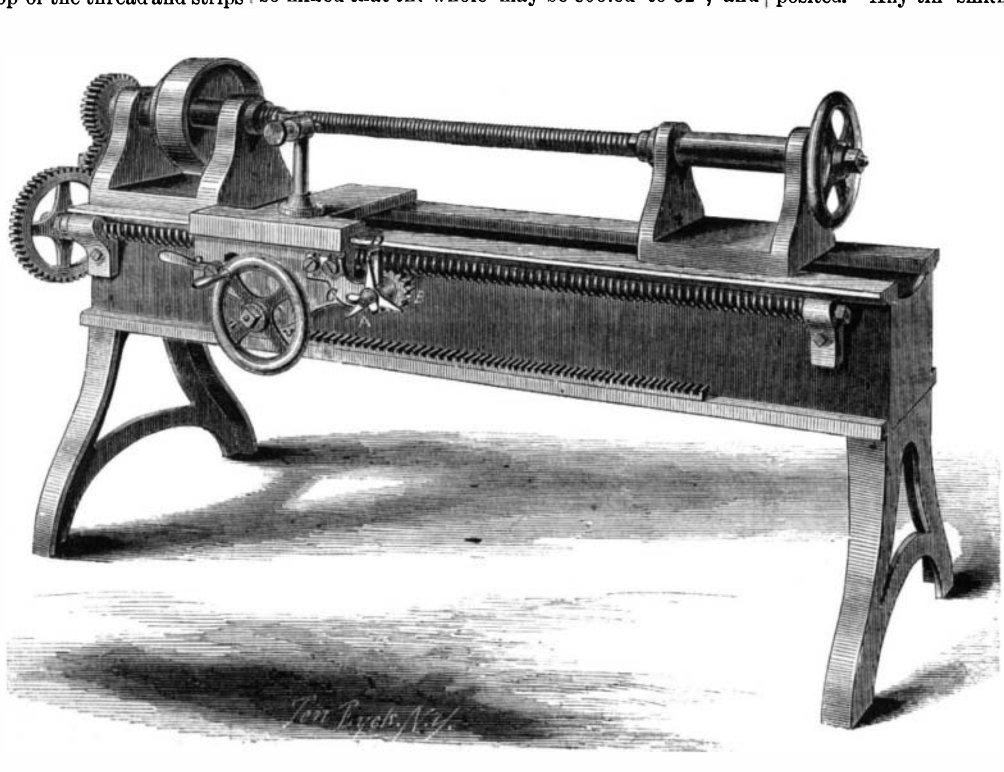
Improved Screw Cutting Index.

All lathemen who have cut screws know that the tool sometimes rides on the top of the thread unless it happens to come in exactly the right place. When the carriage is run back by a cross belt, the tool always comes in the right place, for the relative positions of the tool and the thread are unchanged. It consumes time, however, to do this, and very many mechanics prefer to throw the feed out, run the carriage back by the hand wheel, and jump the tool in as the thread comes round.

The object of this invention is to make the operation certain, for it sometimes happens that the most skillful workman hits the top of the thread and strips it off for a turn or so before he can run the tool back. The index here illustrated consists in affixing a three fingered pointer, A, to a shaft, whereon a wheel, B, is keyed. This shaft runs in a bracket, C, bolted to the apron of the lathe. The wheel is in contact with the lead screw, and when this is in operation the pointer remains stationary.

Now supposing the cut to be started, the pointer will be opposite the vertical arm, D, also on the bracket, and will remain fixed while the feed is in. When the tool has traversed the length of the work the feed is then thrown out and the carriage run back by hand, and when any one of the pointers come opposite the vertical arm the feed is thrown in and the tool can be run in with a certainty that it will also strike the center of the space. This is a very convenient arrangement and can be applied to any lathe in a short time; when not in use it can be detached and laid on one side.

It saves half the time, also the use of an extra belt and one or more pulleys on the counter shaft, and is not liable to derangement. It was patented on Nov. 1st, 1864, through the Scientific American Patent Agency, by J. G. Baker, of the firm of Henry Asbury & Co.; for further information address the above firm, at Nos. 67 and 69 Laurel street, Philadelphia, Pa.



BAKER'S SCREW-CUTTING INDEX.

Gunpowder Explosive by Percussion.

Knapp, in his Chemical Technology, says,

"The inflammability of dry powder by a mere blow without fire is a well known fact, and has more than once been the cause of accidents. That this property is not always due to an accidental mixture of other matters, as sand, &c., but is really a property of the powder itself, was proved by the experiments instituted at Freiberg with blasting powder made from chemically pure ingredients, namely, 63.3 saltpetre, 20.0 sulphur, and 16.7 charcoal. Out of ten samples, which were wrapped in paper, and struck upon an anvil with a heavy hammer, seven of the corned powder exploded, and nine of the powder in the form of flour. Other kinds of powder behaved in the same manner. It is of importance, in the construction of powder mills, to know that the explosion occurs most easily by a blow from iron upon iron, iron upon brass, brass upon brass, even lead upon lead, and lead upon wood, but not so easily from copper upon bronze or upon wood."

SOME time ago some persons who were boring for oil in Wirt county, in West Virginia, and had reached a great depth, dragged up with the pump a piece of calico. The operators were very much astonished at the discovery, and the people in the neighborhood were induced to believe that some persons down in China were sending up specimens of their calico printing

ANCHOR ICE.

Water is at its greatest density at the temperature of 39°·7 above the freezing point. If water, warmer than 39°, is cooled at the surface, this surface water becomes denser than the remainder and sinks to the bottom. By this process the whole body of the water is cooled to 39°, when any further cooling of the surface makes the water less dense, and it remains till it cools to 32°, when it crystallizes into ice. Were it not for this singular property, the whole mass would be cooled to 32°, and frozen solid. Sometimes when water runs in shallow streams over a rocky bed, it is so mixed that the whole may be cooled to 32°, and the freezing may begin at the bottom, producing what is called anchor ice. This we have supposed to be the correct explanation, but a correspondent from Maine speaks of anchor ice occurring in ponds. If it is really observed in deep still ponds some other explanation must be sought.

CADWELL'S PHOSPHATE DISTRIBUTER.

This utensil is intended to facilitate the distribution of fertilizers on corn, cotton, tobacco, or other

plants; either plaster, ashes, lime, salt or phosphates may be used in it. It can also be employed for depositing guano, bone dust, etc. in the hill before planting.

The quantity let on at once can be graduated from a thimblefull to a handfull, and a simple jolting or shaking motion is all that is required to work it. By the employment of this utensil the fertilizer is scattered evenly instead of in lumps or spots, as is the case in more imperfect methods. The garments and person are also fully protected from contact with the noxious and destructive, as well as disagreeable, agents sometimes used. It also expedites the work and is in other respects advantageous. The arrangement is simply a tin case with a perforated bottom, as shown in this engraving, which is covered with a slide, also perforated. On turning the inner slide by the button, A, the apertures are increased or diminished at will, thus regulating the quantity of fertilizer deposited. Any tin smith can make one in a short time. It was patented, through Scientific American Patent Agency, on the 17th of Nov. 1863, by J. R. Cadwell, Dexter, Mich For information concerning rights, etc., address him at that place.

The Ames Gun.

The wrought iron cannon made by Mr. Ames at Falls Village, after having been fired 700 times to test its strength with such immense charges of powder and balls and shells, that Gen. Gilmore, it is said, stated that it was the most severe test any gun was ever subject to without exploding, it is to be tested still further. It is said the government agents have purchased the gun for the purpose of experimenting upon. They intended first to bore out and enlarge the caliber; this, of course, will tend to greatly weaken the gun, and also to admit still greater charges.

Should it then stand the tests which they design to apply, they think of dissecting the animal by cutting the entire gun into thin slices by means of powerful machinery which is estimated to cost $10,000—these slices to be closely examined with a magnifier, for the purpose of finding whether there are any unwelded spots or flaws in the construction of the gun, and also to find if the severe tests which have been applied have caused any slight cracks, or even separation of the particles of iron, which might not be visible on the outer or inner surface. Mr. Ames has completed 10 or 12 other guns like the one above alluded to, which are to be tested this week near his foundery. It is said that the government has contracted for them, and that they are to be put to immediate use. Jeff Davis will then probably hear something he won't like.

The iron of which these cannon are made is the pure "Salisbury Iron," and was smelted from the ore of Messrs Landon, Botsford & Co., at Chapinville in this town, and is what is known among iron dealers as "cold blast charcoal iron," and was received by Mr. Ames in the form of cast iron pigs, and by him converted first into wrought iron, then into the best cannon ever made in America and probably the whole world.

EMIGRATION A LOSS TO COTTON SPINNERS.—Mr Heywood, the Secretary of the Cotton Supply Association, estimated by a division of the margin of wages and profits in 1860, that the sum of £81 would be lost to the trade for every working hand that emigrated. The emigration of 50,000 hands would, at this rate, involve a loss of £4,000,000 a year. He maintained that it would be better to keep 600,000 hands at a weekly cost of 2s. 6d. each, for three years, with a total expenditure of £12,000,000, than to incur a direct loss in that period of £147,000,000 in wages and profits.

IT is claimed that our telescopes are now perfect enough to discover any dwelling over 40 feet high on the moon.

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