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CURIOSITIES OF SCREW CUTTING.

The exact tests in measurements which are now made from precise standards of dimensions in machinists' work reveal some rather humiliating facts to those who have heretofore claimed to build "tools of precision." Standards of diameters and lengths have been acknowledged as difficult to attain to in ordinary work; but it was supposed that screws, particularly the leading screws of lathes, could not vary much in pitch of thread from an established standard. But with tests made by lined hardened steel bars, aided by the microscope, it is proved that the best of screws, as ordinarily produced, are defective. So great have been ascertained to be these defects that a half nut, only three inches long, correctly cut by the aid of the microscope, would ride the thread of an ordinary lathe leading screw of the same supposed and intended pitch. In one instance a leading screw, 36 inches long, with a pitch of six threads to the inch, was tested, inch by inch, the readings being by five-thousandths of an inch, and every inch showed a falling off from the true pitch, the minus in the aggregate being 0·027 of an inch in the 36 inches.

Another screw of the same pitch—6 threads to the inch—was tested inch by inch on a scale of seventy-thousandths of an inch with the following result: Each one of the four columns represents 18 inches, and each figure represents the fraction of one seventy-thousandth of an inch variation from the true pitch. It is curious to observe the jumps in variation in some places. Thus, in the third column there is a jump from minus 42 to plus 369. And this screw was cut by the manufacturers of machine tools that indisputably have no superiors in accuracy.

Lathe leading screw, 72 inches long, pitch 6 threads to the inch. Grade of test, one seventy-thousandth of an inch.

−28	0	−29	−4
−19	−16	−7	−14
−26	−12	+10	−12
−16	+19	+23	−14
−33	−8	−6	0
−15	−8	−12	−32
−12	−14	−17	0
−15	−17	−21	0
−24	−22	−34	0
−33	−9	−40	0
−18	−3	−31	−11
−17	−25	−43	−17
+8	−19	−46	−20
−13	−18	−37	−53
−8	−28	−42	−32
−8	−18	+369	−33
−5	−11	+25	−37
−27	−58	−14	−58
−309	−267	+48	−315

$$\text{Total variation} - \frac{843}{70{,}000}$$

Some thoughtless person may say that the exactions of a microscopical standard to this degree are finical and useless. But let one consider that these variations from the true standard not only repeat themselves, but are cumulative. In the case of the screw first mentioned, there was a minus of the grade or pitch of the thread of 0·027 of an inch in only 36 inches. Should this leading lathe screw be used to produce other lathe screws, it would require only six reproductions to lose an entire thread, even if the rate of loss was only that of the original screw. But, ascertaining and demonstrating these imperfections is of little account unless they can be prevented. This can be done, and leading lathe screws, screws for elevating planer crossheads, and for other exact purposes can be made so as to be absolutely "tools of precision."

CHEWING THE CUD.

Every child living in the country has stood and watched this curious operation, and wondered what the lump was which he saw come up in the cow's throat, and then go down again after she had chewed it for a certain length of time. And perhaps he may have seen the anxiety and turmoil produced on a farm by the report that some one of the cows had "lost her cud," and as the result of this excitement he may have seen the absurd attempt to "make a new cud," in the hope that the cow would by such means be restored to good condition. There is in the minds of a large proportion of the readers of the SCIENTIFIC AMERICAN (which simply means the community) so little correct understanding of the true nature of "chewing the cud," that a few words concerning it may not be amiss.

A very large tribe of animals, of which sheep and cows are only familiar examples, are called in works of natural history *Ruminantia* because they all *ruminate*, they chew the cud. They do so because their peculiar organs of digestion require it; they can get their nourishment in no other way. They have, it is said in the books, four stomachs, but the statement is not strictly correct, for the entire digestion is done in a single one, that which is called the fourth, the other three being only places for preparatory work. Their food is swallowed without being chewed; the chewing is to come later. When this unchewed food is swallowed it passes directly into the first stomach, to use the common term; but the drink which the animal takes goes straight past the entrance of the first into the second. These two serve only to *soak* and soften the coarse food. When the first has done what it can, the food passes out of it into the second, and then the cow or sheep is ready to "chew the cud."

The second stomach, while busily at work in soaking the food, keeps it in motion, and gradually rolls it up into masses, so that in the small upper part there is formed an oblong solid lump of the size that we recognize as the "cud." This the animal throws up into the mouth, and chews with evidently as much satisfaction as the same act of mastication gives us when we put the most delicate morsels between our teeth. When it is sufficiently chewed, the mass is swallowed and its place taken by another which had been rolled up in the mean time.

But the "cud" thus masticated does not return to the second stomach, from which it had come. It passes smoothly into the third, a place for additional lubrication, and then into the fourth, where the true digestion begins and ends.

This is, in brief, the whole story, and we see how naturally the chewing comes in; it is the same as in our own case, only that it is at a different stage of the food's progress. And we see also what "losing the cud" really is. The cow or sheep is suffering from indigestion; the "second stomach" has failed to roll up the little masses suitable for chewing, and there is nothing which the poor beast can bring up. Of course, therefore, the one thing required is to *restore the tone and power of the stomach*; not to burden it with an "artificial cud," which would only increase the difficulty, instead of relieving it.

Flame and Oxidation.

In the course of one of a series of lectures on "Flame and Oxidation" at the Royal Institution, Professor Dewar recently exhibited a machine for the manufacture of ozone on a large scale, constructed by Dr. Wise for use in a health resort under his charge in the Engadine. It had thirty-eight tinfoil plates, and the machine to drive the air through was a small turbine, there being plenty of water to drive turbines in Switzerland. By experiment he proved that platinum black would liberate iodine from iodide of starch, and that it did so by means of the air it carried down into the solution, because platinum black, freed from air by being taken from beneath water in which it had been boiled, had not the same effect. He next showed that the mere presence of platinum black and air would oxidize alcohol into acetic acid, and became greatly heated in the process. In another experiment he showed that the shaking up of granulated zinc with water in a partly filled large bottle would cause the formation of a small amount of peroxide of hydrogen; he further stated that a solution of peroxide of hydrogen in water, although perfectly colorless and transparent, has the power of cutting off the ultra violet rays of the spectrum.

Carbonic acid, he said, is the highest oxide of carbon, and the substances adhere to each other with such tenacity, that even the intense heat of burning magnesium can do but little in the way of separating the oxygen from the carbon, for when burning magnesium is plunged into carbonic acid gas it burns fitfully for a short time, and then goes out. Notwithstanding this strong affinity, the leaves of trees separate the carbon from carbonic acid under the influence of sunshine, but how they do so is not known; the oxygen thus separated does not appear to be ozonized. The red rays of the spectrum are most active in effecting the decomposition in the leaf, and the action of sunlight is clearly one of deoxidation. The carbon is not deposited in its pure state, otherwise it could not move about in the plant; it seems to be produced first in the form of sugar, which is afterward transformed into starch; or it may be that starch is formed first and sugar afterward. As starch cannot move about in the plant, the inference is that sugar is formed first. In another experiment he showed that permanganate of potash—Condy's fluid—is deoxidized by the addition of peroxide of hydrogen, although both substances have strong oxidizing powers.

How Clothes Pins are Made.

A dealer thus describes the manufacture of clothes pins to a reporter: "They whittle 'em out at the rate of eighty a minute. A beech or maple log, a foot in diameter and ten feet long, will whittle up into 12,000 clothes pins. That log won't cost more than $2. The clothes pins they cut out of it will be worth $96.40. It will take them two hours and a half to run that log into clothes pins, which is whittling out 4,800 an hour. At ten hours a day they get away with four logs and have on hand 48,000 clothes pins worth $385.60. Now, the lumber for these pins has only cost $8 or so. But then those logs must be sawed up by four different kinds of saws. One separates the log into lengths of sixteen inches; another saws these into boards three-quarters of an inch thick; another cuts the boards into strips three-quarters of an inch square. These strips are caught on a wheel that hurries them to a gang of saws which chop them into clothes pin lengths. These lengths are carried by a swift moving belt to a machine that seizes them, sets them in a lathe that gives them their shape in the twinkling of an eye, and throws them to an attendant, who feeds them to a saw that moves backward and forward as if it were madder than a snake. This saw chews out the slot that the washerwoman shoves down over the clothes on the line, and the clothes pin is ready, all but kiln drying and polishing.

"The latter is done in a revolving iron cylinder, the same as castings are cleaned. All these processes cost money, and when the manufacturer comes to put up his goods for sale he finds that his profit on the 48,000 pins, his day's work, is only about $193. We pay the manufacturer a cent a dozen, or a trifle more than $8 a thousand. We are compelled, in these close times, to sell them for 4 cents a dozen, or $32 a thousand."

Car Axle Frictions.

At a recent meeting of the American Society of Civil Engineers, a paper was read by A. M. Wellington, C.E., giving the details and results of experiments with a new apparatus upon the friction of car journals at low velocities. These experiments were undertaken to test the correctness of a series of tests described in a previous paper, which were made by starting cars from a state of rest down a known grade, and deducing the resistances from the velocity acquired. The present experiments were made by an apparatus in which the axle to be tested is placed in an ordinary lathe having a great variety of speeds, the resistance of the axle being measured by the levers connected with a yoke encircling the axle and transmitting the pressures to a suitable weighing apparatus. It was found important that this weighing apparatus should be direct, as, for instance, a platform scale rather than a spring scale. The results of these experiments as to initial friction were that friction at very low journal speed is abnormally great and more nearly constant than any other element of friction.

This abnormal increase of friction is due solely to the velocity of revolution. At velocities slightly greater, but still very low, the friction is still large, the coefficient falling very slowly and regularly as velocity is increased, but being constantly more and more effected by differences of lubrication, load, and temperature. A very slight excess of initial friction would generally be observed.

There is no such thing in journal friction as a friction of rest in distinction from a friction of motion. The fact that friction of rest appears to exist is due solely to the fact that no journal or other solid body can be instantly set into rapid motion by any force, however great. At ordinary operating velocities the character and completeness of lubrication seem to be much more important than the kind of oil used, or even the pressure or temperature.

Comparisons were made of experiments by Prof. Thurston and by Mr. Tower, and the experiments of the author. The rolling friction proper in railroad service seems to be very small indeed, not exceeding one pound per ton. As to the resistance of freight trains in starting, it is believed that the resistance at the beginning of motion in each journal is about twenty pounds per ton. A velocity of from one-half to three miles an hour must be obtained before the journal friction falls to ten pounds per ton. At six miles per hour the journal friction is at least one pound per ton higher than at usual working speeds. Temperature exerts a very marked adverse influence upon friction at low velocities. The velocity of lowest journal friction is 10 to 15 miles per hour. With both or other very perfect lubrication there is very slight increase of journal friction accompanying velocities up to 55 miles per hour. With less perfect lubrication, as with pad or siphon, greater velocity is as apt to decrease as to increase the coefficient. The latter being more like the ordinary lubrication in railroad service, we may say without sensible error that the coefficient of journal friction is approximately constant for velocities of 15 to 50 miles per hour.

Silvering Plate Glass.

Silvered plate glass is produced by causing a slight coating of mercury to adhere to the glass. To obtain this result mercury must be retained by a metallic medium; it is, therefore, amalgamated with tin. Mercury, owing to its power of reflecting light very brightly, has been chosen as the best medium.

The operation of silvering is briefly as follows: Upon a very smooth stone table a sheet of very thin tin is spread very carefully, so as to prevent all wrinkles. Upon this sheet mercury is rubbed all over, then as much mercury as the sheet will retain is poured over it. The glass plate is now carefully slipped over the edge of the stone table, as near as possible to the mercury, and lowered on to it. All the parts previous to this operation have been carefully cleaned, and the plate is handled with pieces of tissue paper, to prevent the introduction of dirt. The plate is now covered with a cloth, and loaded with weights to expel the surplus mercury. When the plate has been weighted, the table is slightly inclined, and gradually increasing the inclination from time to time, until the mercury has been sufficiently drained; this generally requires twenty-four hours. The plate is now carefully taken up and carried over to an inclined wooden table, which is depressed gradually more and more to finish draining the mercury until the plate is supposed to be dry.

This is the process which has been heretofore followed altogether, but of late plates have been silvered with a solution of silver. Mercury has deplorable effects upon the health of workmen, as they are exposed to its dangerous emanations; these are rapidly absorbed by the skin and produce the well known and terrible mercurial poisoning. It is hoped, therefore, that mercury will be abandoned, and the new silvering process described below will be adopted in its place. Several methods have been proposed for silver solutions, all springing, however, from the discovery of Liebig, that aldehyde (produced by a partial oxidation of alcohol), when heated with nitrate of silver, the revivified metal covers the glass with a brilliant metallic coating.

Pettijean's operation, now used altogether by the St. Gobain works, is very similar to silvering with mercury. The table, instead of being stone, is a hollow sheet iron table, made quite smooth on its upper surface, and containing inside water capable of being heated by steam, to bring the temperature to 95-104 degrees. Preparatory to silvering the glass it should be thoroughly cleaned. The table being ready, a piece of oil cloth is spread over it, and upon this is laid a piece of cotton cloth. The plates are now put upon these cloths, and the following solutions are poured over them:

Liquor No. 1.—Dissolve in a liter of water 100 grammes of nitrate of silver; add 62 grammes of liquid ammonia of 0·880 density; filter, and dilute with sixteen times its volume of water. Then pour in this liquor 7·5 grammes of tartaric acid dissolved in about 30 grammes of water.

Liquor No. 2.—This liquor is precisely the same as the other, with the exception that the quantity of tartaric acid is doubled, say 15 grammes.

First pour of liquor No. 1 upon the plates as much as will remain upon the surface without running over. The heat of the table is now increased gradually to 95-104° Fah., and in about thirty minutes the glass is covered over with a metallic coating. The table is now inclined and the plates washed with water, which carries off the surplus silver. The table is again raised, and liquor No. 2 is now poured over; in about a quarter of an hour another coat is deposited, which covers the glass completely. The plates are again washed; then they are carried to a slightly heated room, where they are gradually dried.

This operation, as will be seen, is quite simple, and is generally performed by women. The silver carried off in washing and that contained in the cloths is recovered again. Since glass silvered by this process is liable to be altered when exposed to the air, and the coating may become easily detached if not covered over with a protecting coat of paint, the silver pellicle is covered with an alcoholic copal varnish, put on with a brush, and when this is dry a coat of red lead paint is put on.

Plates silvered by this means have more brilliancy than with mercury, but as there is a slight tinge of yellow given to objects reflected by these mirrors, they were at first objected to. This objection has passed away, however, to a great extent, and the yellow reflection has been obviated by giving a slight coloration to the glass. It is said that the new silver process costs about 36 cents per square meter. Inasmuch as such works as the St. Gobian have adopted it, and as the terrible disorders caused by mercury may be thus avoided, there should be no hesitation in adopting this new process everywhere.

The use of platina has been tried for a reflecting surface, but owing to the somber appearance of reflected objects by looking-glasses prepared with it, has not met with a commercial success.—*Glassware Reporter.*

Scarlet Fever by Post and by Ice.

A correspondent of the *Medical and Surgical Reporter* narrates a case where it seems tolerably certain that scarlet fever was transmitted by means of a letter. At least, there is much less room for doubt than in many cases where such a course is popularly assigned. The outbreak was in a country house half a mile distant from the nearest neighbor, and the family had occupied the house for three years; the children had not been away from the farm for two months, and no one had been in the house who had the fever, or been where it was. In fact, no case of the disease had been known or heard of by the physician for some months anywhere in the county. It appeared, however, that the mother had received a letter from her brother only a short time before, stating that his family had just lost a child from scarlet fever. This letter contained a photograph. The letter was received only seven days before the first child was taken sick, and the children all handled the letter and the photograph.

A newspaper reports that scarlet fever has been spread in Gloucester City by school children having eaten ice which had been used by an undertaker on the body of a person dead of the disease. The children picked up the ice in the street.—*N. Y. Med. Jour.*

Poisonous Plants and Flowers.

There are many plants whose leaves, flowers, and seeds contain virulent poisons, which every one should know, so as to avoid them and keep children from them.

Buttercups possess a poisonous property, which disappears when the flowers are dried in hay; no cow will feed upon them while in blossom. So caustic are the petals that they will sometimes inflame the skin of tender fingers. Every child should be cautioned against eating them; indeed, it is desirable to caution children about tasting the petals of any flowers, or putting leaves into their mouths, except those known to be harmless.

The oleander contains a deadly poison in its leaves and flowers, and is said to be a dangerous plant for the parlor or dining room. The flower and berries of the wild bryony possess a powerful purgative; and the red berries, which attract children, have proved fatal. The seeds of the laburnum and catalpa tree should be kept from children; and there is a poisonous property in their bark. The seeds of the yellow and of the rough podded vetches will produce nausea and severe headache.

Fool's parsley has tuberous roots, which have been mistaken for turnips, and produced a fatal effect an hour after they were eaten.

Meadow hemlock is said to be the hemlock which Socrates drank; it kills by its intense action on the nerves, producing complete insensibility and palsy of the arms and legs, and is a most dangerous drug, except in skillful hands. In August it is found in every field, by the seashore, and near mountain tops, in full bloom, and ladies and children gather its large clusters of tiny white flowers in quantities, without the least idea of their poisonous qualities. The water hemlock, or cow bane, resembles parsnips, and has been eaten for them with deadly effects.

The water dropwort resembles celery when not in flower, and its roots are also similar to those of the parsnip, but they contain a virulent poison, producing convulsions, which end in death in a short time. The fine-leaved water dropwort and the common dropwort are also dangerous weeds.

The bulbs of the daffodils were once mistaken for leeks and boiled in soup, with very disastrous effects, making the whole household intensely nauseated, and the children did not recover from their effects for several days.—*The Druggman.*

New Orleans Exposition Building.

The Boston *Herald* says that the main building of the New Orleans exhibition is in some respects the most remarkable edifice ever built in this country. It is much the largest exposition building ever erected in the world. The architect has succeeded, at a moderate cost, in producing the largest single room, every part of which can be seen from any point, of which there is any knowledge. The building is 1,378 feet long by 905 feet wide, and covers 33 acres, or 11 acres more than the Philadelphia Centennial Exposition of 1876. There are 1,656,300 square feet of floor space, including gallery. The reader may form a better impression of the vast dimensions of the structure by imagining three ordinary city blocks one way and five the other covered by a solid roof. And, if he chooses to allow his fancy carry him still farther, he can picture a monster panorama of the world's industry, extending before his vision uninterrupted by a single object except the supports.

The active commercial rivalry of the different sections is aptly shown by the distribution of contracts for the materials. The roof, which will cover 1,000,000 square feet, is being made in Cincinnati. The window sashes come from Milwaukee, Wis. The glazing will be done by St. Louis parties. Four thousand kegs of nails are being shipped from Wheeling, W. Va. Nine million feet of Mississippi lumber will be consumed. A massive group in bronze, typical of America, to be placed over the main entrance, is being made at Canton, O., as are also a statue of Washington and Columbus, and coats of arms of all the States, which will appear in medallion form as part of the exterior ornamentation. Finely modeled cornices are being made at New Orleans. The building will be 60 feet high, with a tower 115 feet high, and the architect has been fortunate in rendering the exterior unique and attractive. A platform will be erected on the tower, reached by elevators, from which visitors may have an exceptionally fine view of the city of New Orleans, the exposition grounds, the Mississippi River, and the surrounding country. There will be one line of gallery extending around the entire circumference of the building, to which visitors will be carried by 20 steam and hydraulic elevators, representing all the manufacturers of these conveyances in this country.

The music hall, situated in the center of the building, will be 364 feet wide, and will comfortly seat 11,000 persons. A platform is being built for 600 musicians. To light the building with incandescent lamps will require 15,000 lights and 1,800 horse power. To light with the arc system will require 700 lamps, and 700 horse power to operate the dynamo. The total steam required for lighting and for the machinery hall will be at least 3,000 horse power. In this estimate is included the power for five arc lights of 36,000 candle power each, which will light the grounds. These are the largest single lamps ever constructed. The cost of this great structure, lacking no single desirable feature for the purpose intended, will only be about $400,000, and the other buildings will be proportionately inexpensive.

Guano Tests.

Probably there is no better method of determining the purity of guano than the combustion test, which is as follows: Pour half an ounce of the guano into an iron ladle, such as is used in casting bullets, and place it upon red hot coals until nothing but a white or grayish ash is left, which must be weighed after cooling. The best sorts of Peruvian guano do not yield more than 30 or 33 per cent of ash, while inferior varieties, such as Patagonian, Chili, and African guano, leave a residue of 60 or even 80 per cent. Genuine guano leaves a white or gray ash; and a red or yellow ash indicates the adulteration with earthy matter or sand, etc. This test is based upon the fact that the most important ingredients, viz., the nitrogenous compounds, become volatilized, and escape when subjected to a sufficient amount of heat. The difference of odor of the vapors evolved in the process, according as we are working with first or third class guano, must also be noticed. The vapors from the better kinds have a pungent smell like spirits of hartshorn, with a peculiar piquancy somewhat resembling that of rich old decayed cheese, while those arising from inferior varieties smell like singed horn shavings or hair.

A Cheap Insect Destroyer.

A correspondent of the *Fruit Recorder* says he has boiled leaves and stems of tomato plants until the juice is all extracted, and finds the liquor deadly to caterpillars, lice, and many other enemies of vegetation. It does not injure the growth of plants, and its odor remains for a long time to disgust insect marauders.