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No. 442,

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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

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."

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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.

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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.

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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."