METHOD OF CORRECTING A LEADING SCREW.

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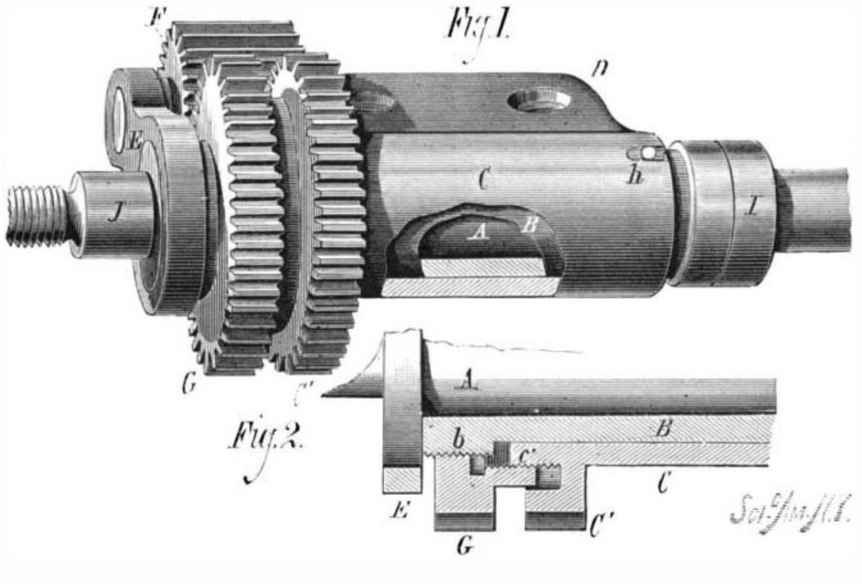
It was recently required, when cutting a new screw at the Pratt & Whitney Company's works, to correct the error in the lead screw of the lathe in which the new one was to be cut. This was accomplished by employing the device shown in our engravings, and which was designed by Mr. A. Swasey. It was first ascertained by testing the lathe that its lead screw was too short by $\frac{7}{100}$ of a revolution in a length of 2 feet, the pitch of its thread being 6 to an inch. Now in 2 feet of the screw there would be 144 threads, and since $\frac{7}{100}$ (the part of a revolution the thread was too short) $\times \frac{1}{6}$ (the pitch of the thread) $= \frac{7}{600}$ (which was called $\frac{1}{85}$), the error amounted to $\frac{1}{85}$ inch in 144 turns of the screw The construction of the device employed to correct this error is as follows: In Figs. 1 and 2, A represents the bearing of the feed screw of the lathe, and B *b* a sleeve, a sliding fit upon A, prevented from revolving by the pin, *h*, while still having liberty to move endways. C represents a casing affording journal bearing to B *b*, having a fixed gear wheel at its end, *c'*, and an external thread upon a hub at that end. D is the flange of C to fasten the device to the shears of the latter, being held by screws. E represents an arm fast upon the collar of the feed screw, and carrying the pinion, F, the latter being in gear with the pinion, C', and also with G, which is a pinion containing two internal threads, one fitting to B at *b*, Fig. 2, and the other fitting to C at *c'*, Fig. 2, the former having a pitch of 27 threads to an inch, the latter a pitch of 25 to an inch.



DEVICE FOR CORRECTING A LEADING SCREW.

The operation is as follows: The ordinary change wheels are connected to the feed screw, or lead screw, as it is sometimes termed, at J in the usual manner. The arm, E, being fast to the feed screw will revolve with it, and cause the pinion, F, to revolve around the stationary gear wheel, C'. F also gears with G. Now F is of 12 diametrical pitch and contains 26 teeth, C' is of 12 diametrical pitch and contains 37 teeth, and G is of 12 diametrical pitch and contains 36 teeth. It follows that the pinion, F, while moving around the fixed gear, C', will revolve the pinion, G (which acts as a nut), to an amount depending upon the difference in the number of its teeth and those of fixed gear, C' (in this case as 36 is to 37), and upon the difference in the pitches of the two threads, so that at each revolution G will move the feed screw ahead of the speed imparted by the change gears, the end of the sleeve, B, abutting against the collar, I, of the feed screw to move it forward.

In this case there are 36 turns of the feed screw, A, for one turn of the nut pinion, G, the thread on sleeve, B, being 27, and that on the hub of C being 25 to the inch; hence, 36 turns of the feed screw gives an end motion to the sleeve, B, of $\frac{1}{25}$ minus $\frac{1}{27} = \frac{2}{675}$, and $\frac{1}{36}$ of that $= \frac{1}{12150}$ of an inch = the amount of sliding motion of the sleeve, *b*, for each revolution of the lathe feed screw. By varying the proportions between the number of teeth in C' and G and the pitches of the two threads in a proper and suitable ratio, the device enables the cutting of a true thread from any untrue one in which the variation is regular.

About Sugar.

Strawberries contain 5·86 per cent of their weight of glucose, cherries 10, white currants 6·40, and hothouse grapes 18·37; pineapples, on the other hand, contain 11·33 per cent of cane sugar, apricots 6, and oranges 4. The sugar cane, when perfectly ripe, contains 18 per cent of sugar. The juice of the sugar beet contains about 14 per cent of sugar. In Havana we learn that there is one cane factory capable of producing 125 tons of sugar per diem. In many factories the use of blood is now entirely dispensed with, though great care is required in the management of the filtration.

FIREWORK MAKING.

This art is, if not really a secret one, very little known to the general public, owing to the danger attending the manufacture, which prevents casual visitors inquiring, and to the nature of the product, which offers no inducements to the analyst.

In calling special attention to pyrotechny as an art well worth cultivating, even although apparently an expensive luxury, we desire to laud the wondrous æsthetic effects of light and color, rather than the mere detonations calculated to impress the savage or the uncultured.

It is a matter of great regret that the results of the pyrotechnist's art are so evanescent, not even ephemeral, but almost instantly vanishing. The stately rocket and its comet-like tail of soft fire, the fiercely hissing gerb, the detonating bomb, and the fountains and myriad devices delighting with swift surprises in coruscation, steady glow, flashing, gleaming, and waning—all minister to our sense of the beautiful, and are well calculated to arouse and to maintain enthusiasm in the cause in which they are offered in honor.

It is our purpose to approach within the precincts, and analyze the modes by which all these effects are produced. It must be premised that the manufacture is dangerous to all concerned in it, principally from the liability to accidents caused by careless strangers. Hence it is secluded and shrouded in mystery. The operatives should be well separated by open space to prevent a petty accident causing a general disaster. There are few, if any, complicated or costly machines. Tables and vises, pans and sieves, pastepots and twine, and a stove, compose the principal "plant."

Nearly all fireworks require paper cases—made of pasted strips rolled around a wooden mandrel. These cases are filled with "compositions" made of "meal powder" (that is, ungrained gunpowder) mixed with various ingredients.

In some "pieces" there is required "force;" in others, color. In the rocket force is most needed; in the Bengal light, color. Roman candles need force and color alternately. For all, the cases need to be light and strong, and it is desirable to have the powder burn as long as possible.

The meal powder is made of sulphur, niter, and charcoal. With this are mixed, according to the result desired, filings of cast and wrought iron, steel, copper, and zinc; dust of camphor, rosin, or lycopodium. To get the brightest red and white sparks, long iron filings free from rust are needed; for brilliant fire with radiations or coruscations, steel filings and cast iron borings. Green flames are given by copper; pale green, by verdigris; palm green, by blue vitriol (sulphate of copper) and by sal ammoniac. Blue is given by zinc; better blue, but with more smoke, by sulphuret of antimony. Yellow comes from amber or rosin, or dry salt. Lampblack makes gunpowder flame red, which an excess of niter tones down to pink. Camphor is used to give an intense white flame; also to give aromatic odors, as do benzoin and storax. Lycopodium gives magnificent rose-colored flames. Hundreds of formulas are given in Spon's "Workshop Recipes" and other works.

The simplest element in pyrotechny is the small paper case called a "lance," used by hundreds in "set pieces." Lance are quills or thin tubes (say 5 inches long) of about ¼ inch bore, and tightly rammed with a color composition. These are closely fixed perpendicularly to frames of desired outline, and their outer ends connected by a quick match so that all burn at once. They should burn about two minutes. The sketch, Fig. 1, shows how a "set piece" would be made.

The large Bengal light case should not burn; and is rammed with color composition. The Roman candle case is thicker and still stronger. It is packed with alternate layers of color, "stars," and projecting compound; the design being to burn with color, and then to shoot out a star which shall burn in the air while more color is burning at the case. The American star, Fig. 2, is a hard dry wad of coloring composition about half an inch each way, and pierced so as to burn inside and out. The English makers make their stars of short thin paper cases, open at each end; or if desired to be changeable, open at one end only, and rammed with two layers of color composition. The star rests on a layer of projecting powder, which sends it out and lights it at the same time.

DETAILS OF FIREWORKS.

The gerb, Fig. 3, is a thick strong case, packed with projecting composition. It is "choked" at one end, so as to give a smooth small outlet for the gases, and thus give them more force. Gerbs are fixed tangentially on a free wheel, Fig. 4, which their combustion causes to rotate. The "choke" is effected when the case is wet, by making one turn of a strong cord near the mouth, and pulling strongly.

The "bomb," which is a magnificent and effective sound and color piece, very expensive, is a hollow sphere of zinc or paper (made in halves and pasted together with muslin), filled with stars just like those for Roman candles and rockets, save that each has a fuse extending through it, Fig. 5. A small quantity of gunpowder among the stars causes the shell to burst and lights the scattering stars. The bomb is fired either from an iron mortar or off a "block," Fig. 6, which is a wooden breech on which a temporary paper barrel is put. There is a "dish" in the top, a little powder is laid in this, the bomb on this, the paper barrel slid over the bomb, and the charge fired. A