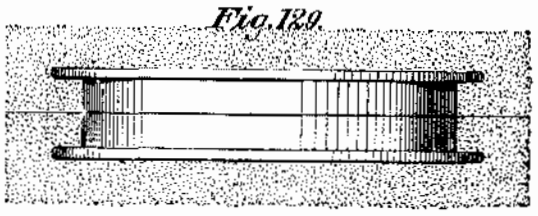
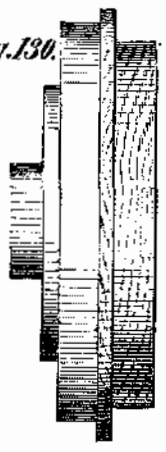
Our fourth example is a double flanged pulley, shown in section in Fig. 128; and our first consideration is how it shall be moulded. It evidently should lie in the sand in the position shown in Fig. 129; but it will be observed that the sand is confined between two flanges, rendering it practically impossible to retract the pattern from the mould, if it is made in one piece. We say, practically impossible, meaning that it cannot be done economically; for strictly speaking, an expert moulder with every requisite appliance, can mould almost anything, as any one will conclude who examines the various works of art in bronze which appear in art exhibitions and elsewhere. Our pattern must, for ease of moulding, be made in two parts. If the disc (or spokes, if it be a spoke-wheel) be sufficiently thick to allow it, the division may be made at the centre, that is to say, on the line A P, in Fig. 128. The operation of the moulder may be understood

Fig. 129.



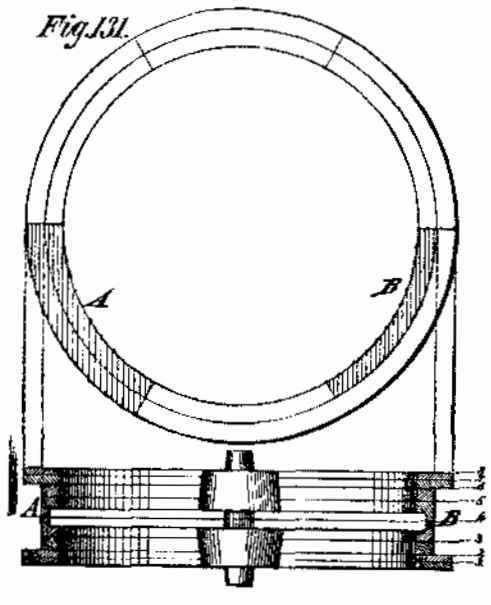
from Fig. 129, three distinct beds of sand being necessary. It may be that a part of a flash is used for each bed, or it may be arranged as shown in Fig. 129, it being a matter of indifference to the pattern maker. In either case, however, draught should be allowed both inside and outside, that is to say, both the interior and exterior diameters of the pattern should be made smallest at the line of parting, the diameters increasing slightly as they approach the flanges. The hubs also should, in like manner, be slightly tapered. Inside sharp corners should be avoided; they should, in fact, always be rounded by cutting them out with a round-nosed tool. To construct this pattern, we proceed as follows: For a small pattern, we take two pieces, somewhat thicker than half the thickness of the finished pattern, and large enough to allow for turning. We then chuck them, as shown in Fig. 130, and turn them up. The recesses shown at the centre by the dotted lines, must be made of equal size in the halves of the pattern; and we prepare a chuck with a projection across the centre to fit into the recess, and thus rechuck the pieces and turn out the opposite sides, cutting the hubs out of the solid. We may then fit a plug into the recess in one half of the pattern, and glue it fast, allowing it to project so as to fit into the recess in the other half; and the pattern is complete, unless the hole in the hub is to be cored, in which case it will be necessary to fix core prints on the top and bottom, in the manner described in our first example.

Fig. 130.



A useful hint may here be given to the effect that when it is decided to fix prints in the centre of a piece of turned work, a slight recess may be made to receive the print, which is then sure to stand true; and should it at any time get accidentally knocked off, as prints often do, another may be immediately affixed without the trouble of finding the centre. The pattern now supposed to be made, though good enough for many purposes, has one great defect which will be readily perceived when we bear in mind our remarks on the properties of timber. It is that it will gradually become oval; and to avoid this, we must

Fig. 131.



have recourse to what is termed building up, a process which must in any event be used if the pattern is a large one. To build up such a pattern, we proceed as follows: After drawing the pulley in section and in plan, as shown in Fig. 131, we divide the whole height of the section into courses, the number of courses being regulated so as to have each of a convenient thickness. It is advisable, however, to have at least two courses in the flange, which will greatly increase its strength. After dividing one of the circles in the plan view into six parts, we draw lines from the points of division to the centre, as shown; and then we make a template of one division, as shown at A, which must be made a little larger than the division, and this forms a template whereby to cut out the segments forming the courses which make up the flanges. A similar template, cut out somewhat larger than the space devoted to B, in Fig. 131, will serve to cut out the sections to be used in forming the body of the pattern. The flanges being made in two courses each, and there being six sections in each course, we shall require 26 pieces of the size of the large template; and allowing each half of the body likewise to consist of two courses, we shall require the same number, to form the body of the pattern, of the size of the small template.

Heating City Houses by Main Pipes.

A paragraph is going the rounds of the newspapers just now, stating that a very novel and at the same time interesting experiment is soon to be attempted in Lockport, N. Y., by Mr. Holly, the waterworks pump inventor. This experiment is to heat the whole city with steam, after the same manner as it is lighted with gas. Pipes are to run to the different houses, and all the occupant has to do is to turn on a faucet and obtain all the heat he wants.

But unfortunately for Mr. Holly, the idea of heating cities from furnaces is not new. It has been suggested a number of times by different persons, and if we mistake not, Mr. L. W. Leeds, author of a work on ventilation and an engineer, in this specialty, tried to organize a company for heating this city by hot air or steam from furnaces placed in different sections of the city and connecting the heat by pipes to our houses in the same way as water and gas are supplied.

Artificial Butter.

To the Editor of the Scientific American:

Owing to the receipt of much correspondence concerning my article on artificial butter, which appeared in the SCIENTIFIC AMERICAN SUPPLEMENT, N. Y., Nos. 48 and 49, I wish to state that I own no patent on the process. The only patent held is Mége's, which is owned by the United States Dairy Company, 6 New Church Street. All letters, therefore, should be forwarded to that address. The process I described in my article is simply an elaboration of that patented by Mége, and cannot be used without infringing on the United States Dairy Company's patent.

HENRY A. MOTT, JR., E.M., PH. D.

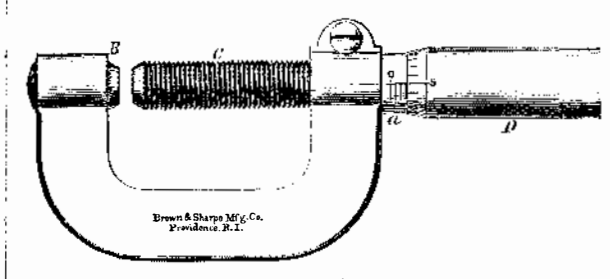
New York City.

A New Use for Gun Cotton.

A wad of old gun cotton, the staler the better, is reported by M. Jacquemin to be an excellent test object for adulteration of wine by fuchsin or orchil. If it be heated with the suspected wine for a short time, it becomes dyed if any foreign coloring matter be present. On moistening the wad with ammonia, if orchil be present, it turns violet; while the fuchsin dye, which cannot be washed out in water, slowly bleaches.

A MICROMETER CALIPER.

IN the accompanying engraving we illustrate a valuable workshop tool, the utility of which, as a reliable and convenient substitute for the vernier caliper for all measurements less than one inch, will be at once apparent. The main piece of the caliper is bow-shaped, with a projecting shank *a*, into which is fitted the screw *c*, which is accurately cut with a thread of 40 pitch. The shank, *a*, has a line of graduations of same pitch as the screw, *c*. The hollow cap, D, which is firmly attached to the right hand end of the screw *c*, fits upon the outside of the shank, *a*. One revolution of this cap opens the caliper twenty-five thousandths of an inch. Parts of a revolution are shown on the line of graduations upon the circumference of the beveled end of the cap, *d*, the value of each graduation being one one-thousandth of an inch in the opening of the caliper. Thus, three whole turns and one fifth of a turn would equal eighty-one thousandths of an inch, inasmuch as three turns equal twenty-five thousandths, and one fifth of a turn (or five of the circular graduations) equal five one-thousandths, making altogether eighty-



one thousandths of an inch. Though graduated to read to thousandths of an inch, half and even quarter thousandths are easily obtained, and measurements are read without the use of a glass. It is provided with screws for adjustment and for holding it securely at any given size. Being made wholly of steel, all the parts are durable, the points of contact also being tempered. It is small, light, well adapted for use as a pocket tool, and will prove invaluable to the better class of machinists and fine tool makers. It is made by the Brown & Sharpe Manufacturing Company, of Providence, R. I.

DYEING COCHINEAL RED ON FLANNEL.—For 22 lbs. flannel, use 1 lb. 10 ozs. oxalic acid, 8¾ ozs. tin crystals, 2 lbs. 3 ozs. cochineal, and ¾ oz. flavin are boiled well together, cooled, the goods entered and winced till the desired shade is produced. If a blue tone is required, no flavin is added; but for yellow tones as much as 1¾ oz. flavin may be used.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

Positions of Planets for January, 1877.

Mercury.

Mercury sets so much later than the sun in the early part of January that it will probably be seen in the twilight. On January 10, Mercury is at its greatest angular distance from the sun, and can be easily found, some degrees north of the point of sunset. On January 1, Mercury rises at 8h. 41m. A. M., and sets at 5h. 47m. P. M. On the 31st, Mercury rises at 7h. 29m. A. M., and sets at 4h. 28m. P. M.

Venus.

Venus must be looked for in the morning. On January 1, it rises at 5h. 11m. A. M., and sets at 2h. 34m. P. M. On the 31st, Venus rises at 6h. A. M., and sets at 3h. 10m. P. M.

Mars.

Although Mars differs from Venus only 1h. 22m. in right ascension, it rises more than 1h. 30m. before Venus, because it is in greater northern declination.

On January 1, Mars rises at 3h. 37m. A. M., and sets at 1h. 26m. P. M. On the 31st, Mars rises at 3h. 18m. A. M., and sets at 0h. 31m. P. M.

Mars is now very small, but it can be known among the stars by its being nearly in the same diurnal path with Venus, and about 20° west of that brilliant planet. Mars can also be known by its position relative to the bright star Antares. On January 24, Mars is a few degress north of Antares.

Jupiter.

Jupiter can scarcely be seen at all. On January 1, it rises at 5h. 54m. A. M., and sets at 3h. P. M. On the 31st, it rises at 4h. 24m. A. M., and sets at 1h. 27m. P. M. On the 31st, Venus, Mars, and Jupiter can all be seen in the morning. Jupiter is the farthest south.

Saturn.

Saturn, which has been so well situated for evening observers during several months past, now comes to the meridian in the afternoon, and on January 1, is in the southwest when first seen, after sunset. On the 1st, Saturn rises at 10h. 22m. A. M., and sets at 8h. 58m. P. M. On the 31st, Saturn rises at 8h. 32m. A. M., and sets at 7h. 16m. P. M.

Low as it is, in the southwest, Saturn, even on January 31, can be seen with small telescopes. A telescope of two and a half inches object-glass will show the curious and wonderful ring, and the largest of its many moons.

Uranus.

On January 1, Uranus rises at 8h. 7m. P. M.; and as it is in good northern declination, it can be well seen by 10h. P. M. A telescope of small power will show it round, and like a very small full moon.

On January 31, Uranus rises at 6h. 3m. P. M., and comes to the meridian at 1h. A.M. When on the meridian, Uranus is almost exactly in a vertical line with the star *Mu Leonis*, and 12° below it. Uranus can also be found from the neighbourhood of the bright star Regulus. At the time of meridian of Regulus, Uranus is 5° west of, and 2° above that star.

Neptune.

Neptune's position is good, in the early evening, but only large telescopes will show it to any advantage.

On January 1, Neptune rises at 0h. 38m. P. M., comes to meridian at 7h. 21m. P. M., and sets at 1h. 55m. the next morning. On January 31, Neptune rises at 10h. 40m. A. M., and sets at 11h. 58m. P. M.

Sun Spots.

A remarkably large spot, followed by a very small one, and surrounded by faculæ, is observed at the present date, December 17, just coming on.

For a very long time, from November 24 to December 17, the sun's disc has appeared to be free from spots, visible with a glass of two and a half inches aperture.

BOTS.

BY PROFESSOR C. V. RILEY.

A correspondent, engaged in the tanning business, asks why "wormals" get into the backs of cattle, and how they undergo their transformations.

Almost all cloven-footed animals, and many other herbivorous species, are infested with bots. These are legless grubs which fall into three categories: 1. Gastric, or those which are swallowed by the animal infested, and which live in the stomach in a bath of chyle. 2. Cervical, or those which crawl up the nostrils and inhabit the frontal sinuses. 3. Cutaneous, or those which dwell in tumors just beneath the skin. They are all the larvæ or early state of two-winged flies (diptera) belonging to the family *œstridæ*, characterized by having the mouth parts entirely obsolete, and popularly called gad flies or bot flies. In the first series, of which the horse bot (*gastrophilus equi*) is the most familiar example, the eggs are attached by the female fly to the hairs of the body, and principally on those parts of the body within easy reach of the animal's mouth. The egg opens with a lid, and the young maggot upon hatching clings to the tongue as the animal licks itself, and is thus carried into the fore-stomach, to which it holds tenaciously by a series of spines around the body, but principally by a pair of sharp hooks at the head. When fully grown, they leave their post with the fæces, burrow in the ground and undergo the final transformation. In the second kind, of which the sheep bot (*œstrus ovis*) will serve as an example, the egg generally hatches