(*Continued from first page.*)

induction valve must, both at the time of opening and closing, be very quick, otherwise wiredrawing inevitably takes place, and this will be evidenced in the rounded corners at each end of the steam line, on the indicator diagram.

It is inherent in simple high pressure steam engines that the power imparted to the driving shaft be variable; because, if we disregard the question of economy, and permit the steam to follow the piston during as large a portion of its stroke as possible, the necessity of having a free exhaust, especially with a high piston speed, demands that the exhaust valve shall open freely before the completion of the piston stroke: while if, on the other hand, we use the steam expansively, the pressure upon the piston (and hence the power communicated by it) decreases from the moment that the induction valve closes until the end of the stroke: in other words, during the whole term of the expansion. It is also found in practice that, even under the most favorable of conditions, the load driven by the engine is variable, and it becomes, therefore, a somewhat complicated problem to devise a mechanical movement that shall sacrifice none of the qualities essential to prevent the wear and tear due to quick motions, that shall establish between the duty and the steam supply to the cylinder are always equal ratio, and which shall, at the same time, maintain a uniformity of engine speed notwithstanding variations in the amount of the duty and in the boiler pressure. In this connection, it may be borne in mind that the variation which may take place in the load of the engine, after the steam supply has been cut off and during the term of expansion, is an element tending to vary the speed of the engine. Nor can this element be counteracted or compensated for, except during the period of admission in the next stroke of the piston. The method which, by common consent, has been adopted to secure economy and regularity of speed, notwithstanding these disturbing elements, is to so attach the governor to the induction valve that the action of the former is communicated instantaneously to the latter, the valve being opened by a positive motion and closed by the action of the governor.

We present in the accompanying engravings views of the Brown engine; and the means by which the before described functions are performed in this engine, may be thus briefly described: In Fig. 2 is shown the valve motion. The steam and exhaust valves are griddle valves, which ensure a large area of opening in proportion to the amount of movement, and give free ingress and egress to the steam; and this it is which, together with the quickness of the valve movement, secures the sharp admission corner and the freedom of exhaust shown in the indicator cards taken from this engine. The valve seats are formed of plates, which may be taken on and off the cylinder; and the part over which the valve travels is raised so that, to true up the seats, the plates may be taken off, and either filed or planed in a few minutes, the operation making no difference to the height of the slide spindles from the seating, thus avoiding a very common defect while simplifying the operation.

The governor is operated by the cut gear wheels shown, which impart a rotary motion to the shaft, A, which operates the governor and communicates rotary motion to the valve shaft, B. Between these two shafts, however, is the friction device, C, which is so constructed as to permit the shaft, B, to be operated by hand independently of the shaft A: and thus the valve motion may be operated by hand independently of the cut gears, which is a great convenience to the engineer in starting the engine. Upon the shaft, B, are the eccentrics, the ends of the straps of which connect with the horizontal lever or arm, E; and the end of the latter extends into the square slot in the slide spindle guide to the catch of the tongue. It is obvious then that, as the shaft, B, revolves, the end of the lever, E, will reciprocate vertically in the said square slot. Turning now to the valve stem and guide, the valve stem is attached to the guide, F, and in the slot shown in the latter is a tongue, G, pivoted by the pin shown in the guide. The upper end of this tongue has a projecting catch upon it; and beneath this catch stands the end of the arm, E. Now the induction valve is closed when at the bottom of its travel, and the weight of the valve and stem and the pressure of the steam (acting on an area equal to the area of the valve stem) are, combined, always acting to keep the valve at the bottom of its travel, that is, in its normal position; and there it remains until lifted for the admission of steam. The manner of effecting this admission is as follows: The end of the arm, E, acting against the catch on the upper end of the tongue contained in the slot shown in the slide spindle guide, F, lifts the valve and holds it open so long as the tongue is not tripped. The instant, however, that the latter action takes place, the valve, from its weight and the action of the steam upon the area above mentioned, closes, the movement being cushioned after the valve is completely closed by means of the small dash-pot shown beneath.

It is evident then that, by regulating the eccentrics, the valve may be given any desired amount of lead, and that the duration of the period of admission may be varied by tripping the tongue before referred to; and this is accomplished by the engine governor in the following manner: The governor acts upon the rod, N, shown in our engraving, the end of the governor spindle being attached to a crank arm attached to the rod, N. Upon this same rod, and immediately behind the induction valve spindle guide, F, is an arm, standing vertically and carrying a pin, H, standing horizontally. Now the tongue, which, at one end, acts as a catch to the eccentric arm at the other end, protrudes from the back of the slide spindle guide, and stands directly beneath the above mentioned pin; so that, when the rod, E, lifts (through the medium of the tongue catch) the induction valve, the latter continues to lift until the tail of the catch, G, contacting with the pin, H, thus tripping the tongue; and the valve instantly closes, returning to its normal position. The action of the governor, then, by controlling the position of the tripping pin, H, controls the period of steam admission, the movement being performed without the interposition of either springs or weights. The exhaust valves lie horizontally, and are operated as follows: Upon the shaft, D, are the discs, J, which are provided with cam grooves. The rocker arm, K, carries a friction roller extending into the cam groove, the upper arm, L, being attached to the exhaust valve spindle. To compensate for the circular motion of the arm, and the vertical movement of the valve spindle, the connection between the two is made by the eye of the spindle, containing a slot, in which is fitted a sliding die to which the pin of the arm is fitted. To regulate the amount of compression, it is merely necessary to adjust the position of the disc. The parts composing the valve motion are simple and plain, involving, it will be seen, no intricacies; and they are easily accessible. The pins and bolts, as also the eyes of all pivoted parts, are made of steel, and are hardened. The rods, A and B, are of steel. The slide spindles and stuffing boxes are of brass, so finely fitted that they are steam tight from the fit without the aid of any steam packing whatever; and it is stated that some of these spindles thus fitted have run a year without requiring any packing. The piston rod and connecting rod are of steel; the crosshead is provided with brass gibs, which are adjustable to take up the wear by means of the check nuts shown. The crank pin and crosshead pin, and all the bolts, nuts, pins, and studs about the engine, are of steel.

The workmanship upon these engines is, both for fit and finish, of the very first order. The joints of parts fitted together cannot be distinguished, nor can the seating of the nuts against the cylinder cover washers be defined by the eye. The whole of the working parts are finished and have a polish upon them equal to silver plating. The governor is of the ordinary fly belt type, and is, for security and safety, enclosed in a polished cast iron casing.

The indicator cards, taken from each end of the cylinder, show the admission and steam lines to be notably perfect, with the corners fully and sharply defined; while the exhaust and air lines are one, at all times when the cut-off takes place so late that the expansion curve does not pass below the atmospheric line.

One of these engines supplied the motive power for the Sawmill Building at the Centennial, and received the highest award in the form of a medal and a special judges' report. Another drove part of the machinery at the recent American Institute Fair, and was awarded the coveted Centennial gold medal. For further particulars, address C. H. Brown & Co., Fitchburgh, Mass.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES.—Number XVII.

PATTERN MAKING.

We need not dwell upon the half core box, which is necessary for this pattern, if the branch stands at a right angle to the body, or the full one, necessary if it is required to stand obliquely. When the body of the T is much larger in diameter than is the branch, we may joint the two in a simpler way, which, so long as it does not entail a great weakening of the body, will be found more advantageous than the method described. This simpler method is: Having found the amount of the length of the branch necessary to allow for curvature of the body (by the process shown in Fig. 116)

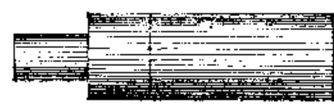


Fig. 124.

we turn upon the branch end an additional projection or stem, as shown in Fig 124, somewhat smaller in diameter than is the branch itself; and we then cut in the body a recess to receive the branch and turned stem or projection, which recess may be either cut out with a gauge or turned out in the lathe, the latter being, for obvious reasons, the best method. For this latter operation, we take a chuck similar to that described in Fig. 58, as a cement chuck;

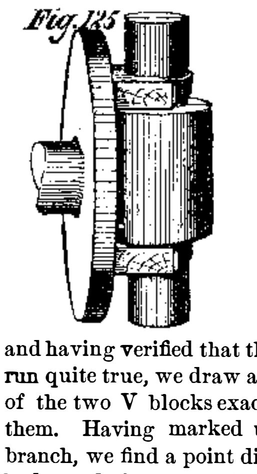


Fig. 125

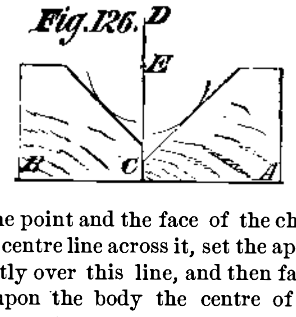
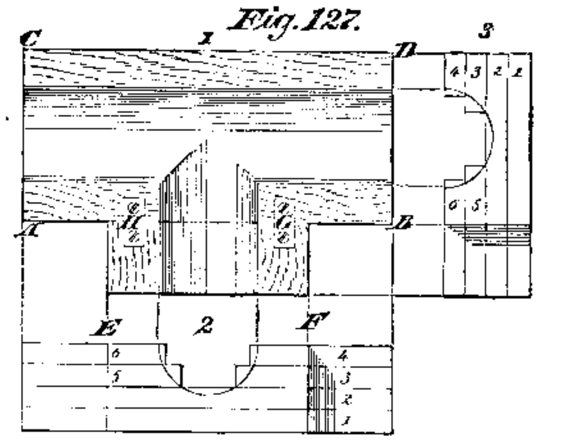


Fig. 126.

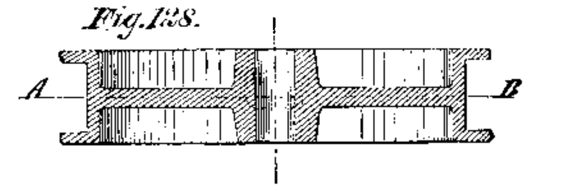
and having verified that the point and the face of the chuck run quite true, we draw a centre line across it, set the apexes of the two V blocks exactly over this line, and then fasten them. Having marked upon the body the centre of the branch, we find a point diametrically opposite to it upon the body, and place the body so that the steel centre point enters the point so found at the same time as the body rests in the V's. We then fix it in this position, by thin straps of hoop-iron, or any other contrivance that will not project so as to prevent the lath rest (or tool rest, as it may be more properly termed) from being brought close to the work. The work must be securely screwed to the chuck, on account of the high velocity of the lathe in turning. To cut out the recess, we commence by placing a centre bit in the back lathe centre, and boring a hole, as large as convenient and very nearly to the required depth. A screw bit is not available for this purpose, for it would in many cases be right through the work before there was time to stop the lathe, which is not usually sufficiently under control. We may next take a turning tool, and turn out the recess to fit the end of the branch; and after taking the job from the lathe, we fasten each half of the branch by glueing and screws. In connection with this method, there is yet another advantage: it is that, by cutting away the body instead of the branch, it renders us indifferent as to whether the shape of the body be spherical, as in a globe valve, or elliptical, or even vase-shaped: because, in this case, the shape adds nothing to the difficulty of the job. Should it occur that one end of the T is larger than the other, we may find the height necessary for each of the V pieces (whereon the body rests during the turning process) as follows: Draw upon a piece of board, the line, A D, in Fig. 126, which will represent the plane of the chuck; and let the point, C, represent the centre point of the lathe. Then, from C, we square up the line D; and we set the compasses to the radius of the body of the pattern at the centre of the place where the branch is to be. We take a radius from C, and about $\frac{1}{16}$ inch up from the line A B, and with this radius, we mark on the line D, the point E. From this point as a centre, we strike the axes, E and F, whose radii correspond to the unequal sizes of the pattern where the V's are required to be. Then we draw tangents to each of these arcs, and complete the forms of the V blocks, as shown in Fig. 127, in which half of each V block is shown.

Fig. 127.



We have now to make a core box for our T; and for clearness of illustration, we will make the drawing somewhat larger than those for the T itself. Fig. 127 represents three views of the core box; that portion which projects below the line, at B, may be made separately, and need not therefore be given any consideration. Having drawn the plan of the box, as shown in Fig. 127 at 1, we draw the end and side views, as shown at 2 and 3, and divide these latter into courses of a thickness to suit the stuff at hand from which the core-box is to be made. The courses may be made of equal or unequal depth. Courses 1 and 2 are got out of the full size of the box, while courses 3 and 4 must be of the length of the box, but their width will differ according to the curvature of the half circle of the core, as shown in Fig. 127, at 2 and 3; 5 and 6 will be similar to 3 and 4, and may be marked from them. All these pieces must be planed to a true surface and glued together, each course being allowed to dry before the next one is put on; but for greater expedition, nails, in addition to the glue, may be used, in which case care must be taken that they do not come so close as to interfere with the cutting out of the half circle. The part, A B, if very short, say under 3 inches, may be made in one piece; but if over 3 inches and not over 6 inches, we take two pieces, of the required length and width, and of half the thickness, and chuck them in the manner previously explained for making flanges in halves; then we place the work in the lathe, and bore a hole for the core, then take them from the chuck and glue them, first together and next to the body of the core box. We next turn the body part of the core to a semi-circle of the required size, and all that will then remain to be cut is that part of the branch that is above the line A B. If, however, the part below A B, in Fig. 127, should be required still longer, then it had better be built up

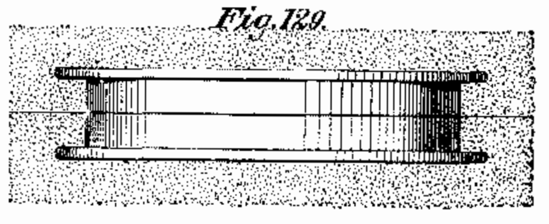
Fig. 128.



in the same manner as the other part. The lengths of the pieces forming the courses will be the same, and may be measured on Fig. 127, from A B, outwards. The widths will differ and may be measured from E or F, inwards. This separate portion, from the grain of the wood being enduric, cannot be firmly fixed to the main body of the box with glue; we must, therefore, in addition, place battens below the box, and let in pieces of hard wood or metal above, as represented in Fig. 127, at G and H.

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.

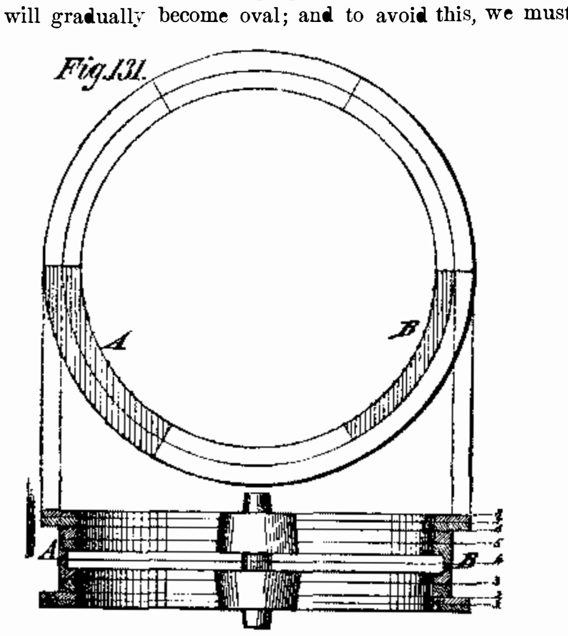


from Fig. 129, three distinct beds of sand being necessary. It may be that a part of a flash is used for each bed, or it may be arranged as shown in Fig. 129, it being a matter of indifference to the pattern maker. In either case, however, draught should be allowed both inside and outside, that is to 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.

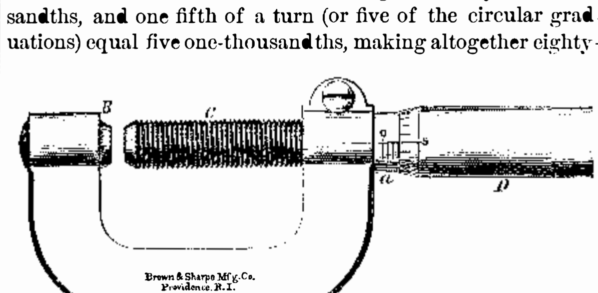
New York City.

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