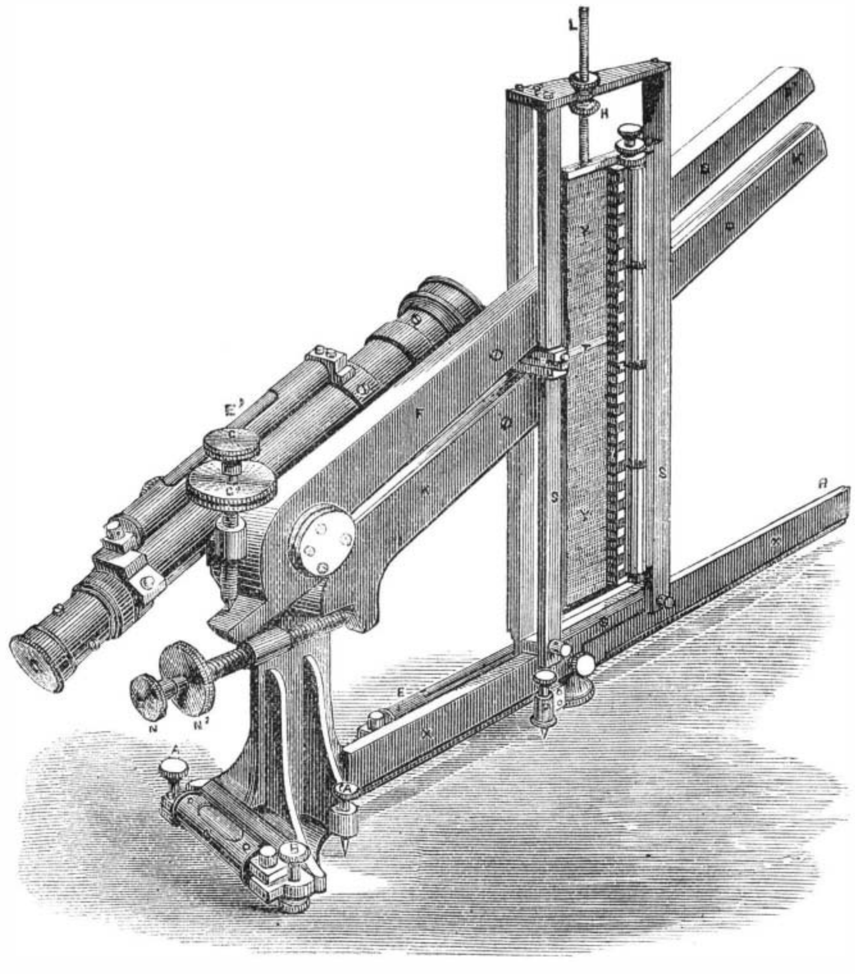
UNIVERSAL FIELD INSTRUMENT.

The instrument illustrated in our engravings, designed by Mr. R. Jahns, and manufactured by Messrs. Smith and Hänsoh, of Berlin, Germany, is intended for the solution of all problems on the field in surveying and leveling; horizontal and vertical points being fixed at one observation, and recorded on any desired scale, upon an index plate. In addition to the instrument itself, shown in Figs. 2 and 3, a plane table and signal staff are necessary. Two marks, *z* and *y*, are placed on the staff, the distance apart depending upon the scale to which the indications on the instrument are to be made.

The construction is based on the two following equations: $C : c = E : e$, and $H : h = E : e$.

The values of these letters will be understood by reference to Fig. 1. In this figure, a^1 represents the indications on the plane table of a point, *a*; *x* is the horizontal projection of a point, *y*, the position of which is the distance, H, above x^1; *c* is a length in the instrument itself; C the distance between *z* and *y* on the staff, as already mentioned. A specialty in the instrument is that the vertical portion, shown in Fig. 1 by *i b*, is, when the instrument is adjusted for the points, *z* and *y*, always parallel to that line, therefore an extension, *d*, of *i b*, corresponds to x^1 in the extension of *z h*. The hight, H, represented in the instrument by *h*, can either be read from a scale or measured off.

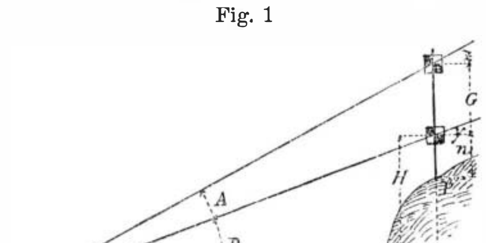
To adjust the instrument it must first be set horizontally on the plane table by means of the screws, A and B (Fig. 2), the levels, E and E^1, being used for this purpose, the small screw, A, carrying a point at the end, being run out until the point at the end enters the table, and round this the instrument can be turned. The vertical frame, S S, is then shifted to the end of the bar, X, and until the small slide, *v*, is out of contact with the inner surface of F and K. The slide, V, carries upon it, connected by a small lever, K, the constant length piece, *c*, of the instrument, and which is formed of a steel plate.



JAHN'S UNIVERSAL SURVEYING INSTRUMENT.—Fig. 2

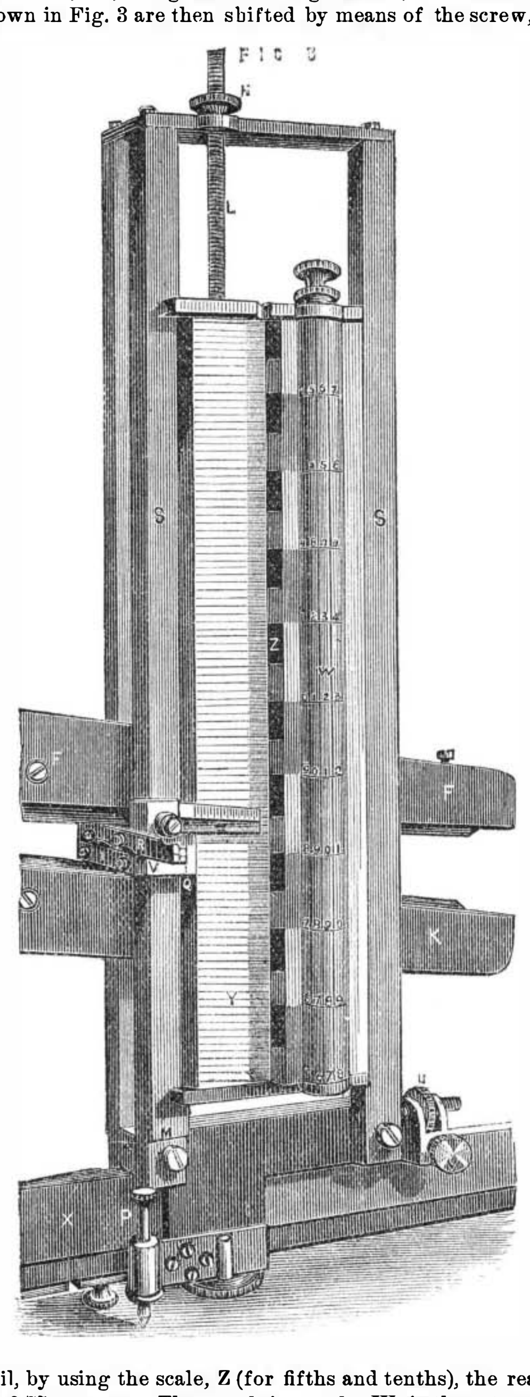
If P, Fig. 1, represents the point of which the horizontal and vertical positions are to be ascertained, the staff is placed vertically over this point. The screw, ●, Fig. 2, is then turned until the guides, F and K, are quite closed, that is, until the steel edges, with which the guides are provided, are in contact. The telescope is mounted on F in such a manner that its optical axis is parallel to the steel edge. By manipulating the coarse and fine adjustment screws, N and N^1, the bars, F and K, and with them the telescope, are raised until the cross wires coincide with the point, *y*, in which case the steel straight edge forms the upper side, *a i*, of the angle, D, and the base of angle, A, Fig. 1. Before and after each observation, the horizontality of the instrument should be verified by the spirit levels. By means of the screw, ●, the telescope is set to the point, *z*, and in this position the steel straight edge and the optical axis coincide with the upper side of the angle, A, Fig. 1, while the straight, K, has retained its former position. By these operations the angles, D and A, are measured

Fig. 1



The frame, S S, is then run back, until the small steel plate, *i*, and the lever, R (which is always kept against it by means of a light spring, as shown in Fig. 3), come in contact with the straight edges. Care must be taken, in order to secure accurate results, that the pieces, *i* and R, only touch the steel edges, but are not pressed against them. When in this position the frame, S S, is clamped to the guide bar, *x*, by means of the set screw, V. On reference to Fig. 3, it will be seen that the lever, R, is extended in front of the frame, S S, and a similar extension forms a part of the slide, V, and the ends of both these pieces have a line marked across them horizontally. When fixed, as before mentioned, a fine adjustment for the frame, S S, can be made by means of a micrometer, U, and by this adjustment the lines on the ends of the pieces, R and V, can be brought into coincidence. Then the upper edge of X *r* will represent the position of the point, *b*, Fig. 1, and the lower edge of *i*, that of point, *i*, in Fig. 1, corresponding to the points, *z* and *y*. The instrument may now be checked for its horizontal adjustment; and if this be found correct, the head, P, of the spring pointer may be depressed, and will make a mark on the paper upon the plane table. The hight of the point, *y*, is found by means of the vernier, *t*, on the vertical scale of S S, Fig. 3. In ascertaining the hight of a point, two cases may be considered: either the hight above a given datum line has to be ascertained, or the hight of a point above the common horizon has to be found

In the first case it is only necessary to read the hight upon the scale after each observation. To illustrate the second we will take an example. Let the hight of the fixed point be 386·75 feet; the scale on the instrument has to be adjusted as follows· The staff has to be placed over the fixed point on the ground, and the situation of this point is recorded by the instrument as described, and marked on the paper by P, the frame, S S, being fixed to the guide bar, X. The scales shown in Fig. 3 are then shifted by means of the screw, L,



until, by using the scale, Z (for fifths and tenths), the reading 6·75 appears. The revolving scale, W, is then turned until the figure 8 appears adjacent to the scale, *z*, and coinciding with the bottom line of the division on the scale corresponding with the figures 6·75. By this adjustment the instrument is set to the required scale, and hights of points recorded are read off without any calculation. The figure 3 (of the quantity 386·75) is added to the readings so long as the hights exceed 300 feet.

In ascertaining the differences in hight between two stations, it is necessary to ascertain the hight of the horizon of the instrument on the scale, Y. To do this, the steel edges of F and K are brought into contact, and these edges are adjusted horizontally by means of the spirit levels on the telescope, Fig. 2. The steel edge, F, is then lifted, and the scales on the frame, S S, are used as already explained; and when *i* is in contact with the steel edge, K, the reading on the scale gives the horizon of the axis of the instrument. In measuring differences of hight with reference to a point already given, the situation plan is attached to the plane table, and the instrument is placed on the plan in such a manner that the point, *d*, is exactly over the given point, *a*. The telescope is then set to any point of the staff, say to *y*, the frame, S S, is shifted with its point, P, over the corresponding point on the plan, the slide, V, with the piece, *i*, is set in contact with the steel edge, K, and the hight can then be read off the scale, Y Y.

Special advantages are claimed for this instrument in preparing geological surveys, as by the same observation hights and distances can be recorded; and when a sufficient number of these have been laid down, strata lines can be plotted upon the field. For making transverse sections, it also affords special facilities, as the vertical hights, y^1 y^2, are indicated on the table in horizontal distances corresponding to the real distances, thus avoiding the necessity of readings from the scale. The hights can afterwards be measured and written upon their respective lines.

If employed as an ordinary leveling instrument, no plane table is necessary, and it may be screwed upon a tripod and adjusted in the ordinary manner. The arrangement is such as has been already described, that any desired scales can be employed, the conditions regulating the employment of these scales being as follows: 1, the distance apart of the marks on the staff, and 2, the distance between the upper edge of the lever, V, and the bottom edge of the plate, *i*, when R is in such a position that the mark in front lines with the fixed mark on the slide, V. In the ratio $e : E = c : C$ the various parts may be adjusted to suit different conditions: but it is advisable, to insure accuracy, to keep C as large as possible, because the greater the angle of sight, the more certainty there is of accurate measurement. The most commonly used scales are supplied with the instrument, and the subjoined table gives the corresponding distances between the marks on the staff:

Scale.	Length of Constant c in millimeters (millimeter=0·39 inch).	Distance apart of Signal Marks on Staff in meters (meter=39·3 inches).
1: 200	15	3
1: 200	25	5
1: 500	10	5
1· 500	5	2.5
1: 1000	5	5
1: 2000	2.5	5

In changing the scales, all parts already described, which are connected with the slide, V, must be changed, and a new scale inserted in the frame, S S.

Both of the signal marks on the staff are adjustable, and are kept in the desired position by means of set screws. The degree of accuracy obtained with this instrument is stated to be quite sufficient for all practical purposes; and if the observer works with care, remarkable precision is obtained. The greatest source of error is caused by wear of the piece, *c*; but this can be corrected by making allowance for the same in the distance between the marks on the staff.

Wind Instruments.

Dr. Burg, a French physician, has published a little book in which he endeavors to controvert, by reference to his own observations and personal experience, the notion commonly entertained that the use of wind instruments is injurious to individuals characterized by pectoral weakness. He remarks "Many philanthropists, on seeing our young military musicians wield enormous wind instruments, have sorrowed over the few years the poor fellows have to live. Well, they are mistaken. All the men whose business it is to try the wind instruments made at the various factories before sending them off for sale are, without exception, free from pulmonary affections. I have known many who on entering on this calling were very delicate, and who, nevertheless, though their duty obliged them to blow for hours together, enjoyed perfect health after a certain time. I am myself an instance of this. My mother died of consumption, eight children of hers fell victims to the same disease, and only three of us survive—and we all three play wind instruments. The day is not far distant, perhaps, when physicians will have recourse to our dreaded art in order to conquer pulmonary diseases."

BATS are said to be inveterate enemies to mosquitoes. A gentleman in New Albany, Ind., it is said, keeps a bat in his bedroom during the season, to protect him from these pests