Kidder

DEPARTMENT OF THE INTERIOR,

GENERAL LAND OFFICE.

806 Railroad Building,

Denver, Colo., April 13, 1912.

Div. "E":
Final report
of merits and
specifications,
Y.& S. solar
transits.

File

The Commissioner of the General Land Office,

Washington, D. C.

190372
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Sir:

I am in receipt of letter dated March 22, 1912, from Supervisor Johnson, transmitting copies of letters from Messrs. Chubb, Harrison, Horton, Spafford and Walker, U. S. Surveyors, all reporting upon the merits of various models of Young and Sons solar transits, and each expressing his personal recommendations in regard to desired modifications in the specifications of these instruments. The reports were received in pursuance of suggestion contained in my letter "E", dated Nov. 16, 1911, subject: "Special report: Inefficiency of 1911 model Y. and S. solar transit". My personal recommendations in this matter are contained in the latter letter. I am requested by Mr. Johnson to submit a recommendation to you, harmonizing, so far as possible, the views of the several surveyors.

The first conclusion reached in reviewing the several reports is that it is impossible to combine in one instrument all of the features in demand. As the result of this conclusion, the following recommendation is submitted:

(1) Where extreme lightness and portability is an important factor, the Buff model 3f transit with Smith solar

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attachment is to be preferred to the Young & Sons No. 10 mountain solar transit. The following tabulation is a comparison of weights:

	Transit.	Tripod.
Buff model 3f with Smith solar	9½ lbs.	7 lbs.
Y.& S. " 1911 " " "	12¼ "	8¼ "
" " " " 1901 " " "	13¾ "	8¼ " .

It is thus seen that a reduction of 5½ lbs. is accomplished in favor of the Buff instrument as compared with a reduction of only 1½ lbs. between the 1901 and 1911 Y. & S. instruments, notwithstanding all of the objections attributed to the latter.

With only minor improvements the Buff instrument will surely qualify, and it will then only remain to be determined by considerable field test whether or not an instrument of this weight will perform properly in regular continuous service if carefully handled.

The second conclusion reached is that there will be more or less call for instruments with the enlarged solar and for instruments containing aluminum parts, there being more or less tendency to the conclusion that the objections to the latter will not obtain in regions of dry climate. Bearing in mind all of the objections to instruments with aluminum parts, and objections on account of lack of stability of adjustment and lack of compactness, the following recommendation is submitted:

(2) The General Land Office is already in possession of a large number of instruments equipped with the enlarged solar, also a large number of instruments containing aluminum parts, by which a small reduction in weight is secured; at least for the present, therefore, I recommend that requisitions for instruments of these models be filled by transfer of those already on hand.

The third conclusion reached from a review of the reports of the various surveyors is that the 1901 model Y. & S. solar transit has the advantage over the 1911 model in general detail of construction and quality of metal, which results in stability of adjustment, compactness and long life. The 1911 model possesses the advantage in a few minor details of construction, and is slightly lighter in weight. I believe that it is generally conceded that the Y. & S. No. 10 mountain solar transit comes nearer to meeting the general requirements of the surveying service than any other one instrument. The present discussion and comparison of models is in the interest of combining in one instrument the best details of all No. 10 models, and to eliminate retrograding changes.

In this connection the surveyor should meet the instrument maker on common ground, and concede to the judgment of the latter on questions of practicability of construction, stability of adjustment, and compactness of design. On the other hand, the makers will undoubtedly accept with finality the conclusions

of so many experienced surveyors, all with friendly interest in the instrument.

Comparison of Instruments.

Transit.	No. 7058.	No. 8536.	Superior.
Diam. of horizontal circle	4 3/4 ins.	4 3/4 ins.	Equal
" " vertical "	4 1/4 "	5 "	1901
Height to horizontal plate	4 1/4 "	4 3/8 "	1901
" " " axis	9 3/8 "	10 1/4 "	1901
" " top of guard	11 1/2 "	12 7/8 "	1901
" of standards	5 "	6 "	1901
Width " " at base	3 1/8 "	2 "	1901
Length of needle	3 1/4 "	3 1/4 "	Equal
" of telescope	8 1/2 "	10 "	1901
Lower clamp and tangent	Inferior	Superior	1911
Plate " " "	"	"	1911
Vertical" " "	"	"	1911
Metal	Bronze	Aluminum	1901
Quality of metal	Superior	Inferior	1901
Total weight with solar	13 3/4 lbs.	12 1/4 lbs.	1911
Precision of transit	Equal	Equal	Equal
Stability of adjustment	Superior	Inferior	1901
Life of transit	"	"	1901
Verniers of vertical circle	Two	One	1911
" " " "	Flush	Beveled	1911
Solar.			
Radius of latitude arc	2 ins.	3 1/4 ins.	1901
" " declination arc	2 7/8 ins.	3 7/8 "	1901
Hor.dist.bet.lower adj.screws	2 7/8 "	1 5/8 "	1901
" " " upper " "	0 5/8 "	1 1/8 "	Neither
Vert. " " " "	2 7/8 "	3 1/8 "	1911
Length of telescope over-all	7 1/4 "	7 3/4 "	1901
Construction of adjusting screws	Abutting	Capstan	1911
" " latitude arc	180° arc	90° arc	1901
Stiffness of " "	Superior	Inferior	1901
Precision of solar	Equal	Equal	Equal
Stability of adjustment	Superior	Inferior	1901
Adaptability to high latitudes	Inferior	Superior	1911

A general criticism is made of both the 1901 and 1911 models in respect to the vernier and compass glass construction, the graduations of the horizontal circle, certain details of the

solar attachment, and of the winged tripod clamp screws, the latter criticism only when working in regions of dense undergrowth.

As a result of the third conclusion and comparison of models, the following recommendation is submitted:

(3) Specifications for Young & Sons
No. 10 Mountain Solar Transit.

Diameter of horizontal circle 4 3/4 ins., graduated to read from 0° to 180°, to both right and left, in two rows, zeros 180° apart, and double opposite verniers reading to minutes;

Diameter of vertical circle 4 1/4 ins., graduated to read from 0° to 90° in each quadrant, one double beveled spring vernier reading to minutes, and guard;

Radius of latitude arc 2 3/8 ins., 180° arc, one double vernier reading to minutes;

Radius of declination arc 2 7/8 ins., one double vernier reading to minutes;

All circles and arcs graduated to 1/2 degrees, all verniers spaced to 30 minutes;

Level to telescope;

Erect eye-piece;

Fixed stadia wires, ratio 1:132;

Colored glass shade in dust shutter of eye-piece;

Needle 3 1/4 ins., variation plate reading to minutes;

Adjusting axis for solar and combined hanging and striding level;

Diagonal eye-piece;

Reflector for cross-hairs;

Waterproof cover;

Regular box fittings, including reading glass, plummet, sun-shade, large and small screw drivers, assorted adjusting pins, spanner, oil can, and assorted brushes, fine, intermediate and coarse;

Case and shipping box with hinges, lock and cushions;

Extension tripod, each with extra set of clamping bolts, hexagon headed and notched; and

Leather case for tripod, grip handle only (Shoulder strap never used).

Instrument to be constructed of the best instrument bronze, homogeneous throughout, as far as consistent, including counterpoise; short telescope; wide and low standards; and general details of construction similar to the 1901 model, with the following modifications:

Lower clamp and tangent, upper clamp and tangent, and vertical clamp and tangent constructed similar to the 1911 model;

Three adjusting posts for solar frame, spaced as far apart as possible, the two lower ones horizontal and the third in the center above; all with capstan nuts.

In addition to the above, the makers' attention is invited to a correction of the following troubles:

Compass and vernier glasses must be made absolutely waterproof, lack of this requirement is very troublesome in damp climates;

A shorter spindle with greater diameter has been suggested;

The construction of the collar bearings of the auxiliary telescope in the 1901 model is superior to that of the 1911 model; the collimation is easily disturbed in the present model on this account; the construction of the bearings of the "Y" level is superior to either, and would admit of removing the auxiliary telescope to clean the bearings;

A means of adjusting the axis of the auxiliary telescope at right angles to the axis of the latitude arc would be very desirable if the necessary stability could be secured; and

A means of adjusting the vernier of the latitude arc to the plane of the arc would be very desirable; a flange might be placed on the vernier to operate in the channel of the latitude arc; this channel is already cut for the clamp; thus the latitude arc would be stiffened and held to the plane of the vernier.

The change from four to three adjusting posts will eliminate the danger of straining the frame of the solar attachment and simplify the adjustment of the solar.

The change in the radius of the latitude arc from 2 ins. in the 1901 model to 2 3/8 ins. in the proposed model appears to

be possible on account of the change from abutting adjusting screws to the adjusting posts and capstan nuts; the former had to be exposed to access with a screw driver, while the latter are reached with adjusting pins held in the same plane as the capstan nuts; the proposed radius of the latitude arc would make this equal to that of the horizontal circle; I see no reason why there should be further increase; the radius of 2 7/8 ins. in the declination arc of the 1901 model is 1/2 in. greater than the radius of the horizontal circle, and I see no logical reason why the radius of 2 7/8 ins. should be increased, especially when such increase is at the sacrifice of stability.

Full 180° revolution to the auxiliary telescope must be provided for all positions of the declination arc, and all positions of the latitude arc to 50° N.; this will probably be impossible to 66° N. latitude in the 1901 model; in which particular the 1911 model is superior.

The construction of the instrument and position of the reflector should be such as to reduce as far as possible trouble due to a shadowing of the sun's rays; less delay or trouble would result in the work if the solar attachment were mounted on the east standard.

(4) Finally, I recommend that careful attention be given to each and every instrument as delivered, considering

carefully the general finish and accuracy of adjustment, and that all instruments failing to qualify be promptly returned to the makers for correction.

Very respectfully,

FAL.

Arthur D. Fiddes

Supervisor of Surveys.