William

Description of

the solar compass.

1844

DESCRIPTION

OF THE

)LAR COMPASS,

TOGETHER WITH

:CTIONS FOR ITS ADJUSTMENT AND USE.

BY

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No apology is thought necessary in presenting to th
veyor the following brief remarks, on the best met
adjusting and using the Solar compass, in as much as
the first published work on this subject.

No reference will be made to the theory or prac
surveying, any further than it is necessary to expla
use of this instrument. Imperfect as this attempt m
it is hoped that it will be found useful to the survey
acquainted with the Solar Compass.

SOLAR COMPASS, &c.

Introduction.

The object of the following pages, is to throw some light
the principles of the Solar Compass, and of the best known
ethod, of adjusting and using the same. The writer be-
ving it impracticable to accomplish this object, by a refe-
nce to a drawing of this instrument, he will therefore refer
the improved Solar Compass, manufactured by William J.
oung, of Philadelphia; and suppose the reader to have one
these, or a similar imstrument before him. He will also
ke it for granted, that the reader possesses a general know-
lge of angular instruments, and of the theory of surveying.

Parts of the Solar Compass mentioned.

The Solar Compass, being an astronomical instrument, he
ho would study or use it to the best advantage, should have
clear knowledge of Astronomy, as far as it is applicable;
so, clear views of the principles on which the Solar Com-
ss operates, in order to work understandingly in making
various adjustments, and skillfully using the same.

The following parts of the improved Solar Compass, will
understood, by inspection. This instrument has two main
ates, the upper and the lower. The lower plate is that on
hich the sights are placed, and it revolves underneath the
pper plate on a centre, while the latter remains stationary,
nd it may be clamped in any position, to the upper plate;
ere is also a graduated ring on the under plate, which
covered by the upper, except two openings at opposite

points, with verniers to read angles. Upon the upper is placed a needle box, having divisions for the north the needle only of about 36 degrees, with a vernier t the needle's variation; also, upon this plate, is plac solar apparatus, consisting of a latitude arc, declinatic and an hour circle or arc, with two spirit levels, pla right angles with each other, together with other nec fixtures.

The latitude arc is that which is attached by screws plate, and stands nearly vertical to it; the hour a partly horizontal over the levels, and the declination placed upon a revolving limb, above the plate, and fixtures of the solar apparatus; upon this revolving li placed another movable limb, which turns on a joint end, and the other end, with a vernier, moves over t clination arc, with a clamp screw, to clamp it to the su clination for the time being; at each end of this last bed limb, there is attached to it a small brass plate ing out at right angles with the limb, and into the upp of one and the lower side of the other, is set a small c lens; opposite to each lens on the brass plates there tached a small silver plate, by means of three small s and on each of these, lines are drawn at a suitable di apart to embrace the sun's image, which falls upon eac the lenses. It will be seen, by inspecting this part of t strument, that it must be used one end towards the sun, he has north declination, and the other end for south nation.

The other parts of the Solar Compass, undescribed will be understood by any person acquainted with surv *nstruments.*

Apparent motion of the Sun, &c.

With a view to gain a more clear understanding of the se of the parts of the solar apparatus, above described, I ould call the attention of the reader to the apparent motion f the sun or stars, around the earth, regarding the earth as he centre of their daily revolutions. A distinct view of the pparent conical motion of the sun, &c., when they have orth or south declination, is necessary, in order to under-tand how the movable parts of the solar apparatus may be o adjusted, as to trace the sun, in his apparent course, while he sights of the Compass remain stationary.

Perhaps this subject cannot be better illustrated, than for he reader to imagine himself standing upon the earth's equa-or, and the sun having no declination, the sun would rise to im due east, and set due west; at noon it would be in the enith, and in the nadir at midnight. In other words, when he sun has no declination, his apparent revolutions is in a erfect plane with the earth's equator; and again: if a traight line be drawn from the rising to the setting sun, nd from the sun at noon and at midnight, both of these lines ould pass through the earth's centre, and the equator would ntersect these lines. But not so when the sun has north or outh declination; for his apparent motion will have an an-le to the above described plane or lines, with the earth's entre, equal to the amount of the sun's declination north or outh—thus it will be seen, that when the sun has north or outh declination, and the earth is regarded as the centre of is revolutions, the plane before mentioned, becomes coni-al. This apparent conical motion of the sun may be urther brought to view, by the dishing wheels of a carriage, he rim representing the sun's apparent path, the hub, the

earth, and the spokes, lines drawn from the sun's path. what has been said, it may be seen that a line drawn fi the sun to the earth's centre, would pass north or south the equator, equal in degree to his declination north south.

The reader is referred to some work on Astronomy learn how the apparent path of the sun in the heaven brought about, by the diurnal revolutions of the earth, the inclination of its poles to the plane of its orbit; I would add, that these remarks apply to the apparent re lutions of the planets and fixed stars, also.

Position of the Solar Compass on the Equator, &c.

I will now suppose the Solar Compass to be placed on equator, and its latitude and declination arc set at 0 or ze and standing in a position for an observation, the axis of revolving limb will be parallel to the poles of the earth, the revolving limb will play vertical to the equator, and the sun's apparent path, when he has no declination, should be kept in this position in all latitudes. It may r be seen, that the demand for north and south declination precisely met, by setting off the sun's declinati.n on the clination arc, and that part of the revolving limb holding lenses, will have the same conical motion as the sun in heavens; and it will be further seen, that there is only position in which the Solar Compass can be placed, that revolving limb will follow the sun's apparent path. It from this principle of the instrument, that the true merid is obtained, and the variation of the needle from it, fou The reader will do well to consider, while examining th principles of the Solar Compass, the position the instrum *would occupy on the* equator, when in use, and also, w

ıge of position it would undergo, in respect to the horias he recedes from the equator, toward the poles of the h.

would here remark, that the accuracy of the surveys e with the Solar Compass, will depend on the correct adnent of its various parts, and a proper method of using

How to adjust the Solar Compass.

lace the instrument on the tripod, and level it or nearly ›y the hand, then by means of the leveling screws, at the ır end of the ball and socket, bring the bubble in each l, accurately to the middle of its opening, if these bubremain at the middle of the openings, while the comis turned horizontally around, this adjustment is right, f they do not, the levels must be so adjusted, by means e screws at the end of each, for that purpose.

would here mention, that in all observations with the r Compass, for the purpose of making its adjustments, or ıd the variation of the needle, &c., the sun's declinashould be taken from a nautical almanac, and reduced e hour of observation for the longitude of the place, that .e sun's declination for noon at Greenwich, would be his nation for 6 o'clock, A. M. ninety degrees west of that ›, or at Dubuque, Iowa Territory. The latitude called y the instrument, should be set off on the latitude arc, :he compass correctly leveled; these pre-requisites are ssary, to a good observation. The observer will also be ı assisted by a good reading glass, to examine the ver-ı, sun's image, &c.

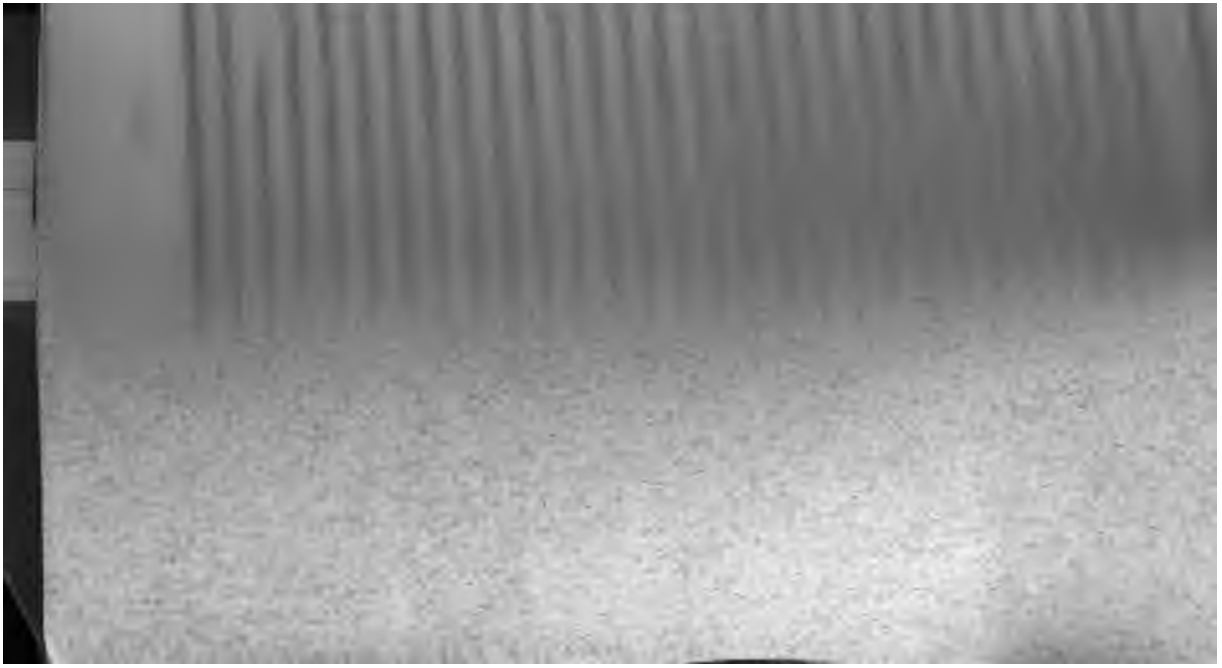
How to adjust the silver plate to correct the index error of the declination arc.

In the next place, set off the sun's declination on the declination arc, for noon of the day of observation; also, set off on the latitude arc, the latitude of the place, as nearly known, and clamp the sights of the compass, for a north and south course; then place the sights in that direction, as nearly as you can by the needle, and accurately level the instrument; then, at fifteen or twenty minutes before noon, if the sun has north declination, bring the end of the revolving limb that has the declination arc upon it, towards the sun; but if the sun has south declination, the other end; in such a manner, that the sun's image from the lens towards the sun will fall on the silver plate at the opposite end of the limb, and observe if his image is embraced precisely between the horizontal lines on this plate, without regard to the vertical lines, which are only used for time. If it be not, alter the latitude on the latitude arc, until it will be so embraced, and continue to keep it so by means of altering the latitude, if necessary, until the sun culminates, and make a note of the latitude given by the instrument. The sun's declination must now be set off for 4 or 5 o'clock, P. M., if the declination be north, or about 3 o'clock if it be south, and when the hour arrives for which the declination has been set off, the compass must be leveled, and the sights directed N. & S. then bring the revolving limb to bear upon the sun as before, and turn the instrument a little, if necessary, by the ball and socket, to bring the sun's image precisely between the lines on the silver plate. You will then cause a stake to be set, at 4 or 5 chains distant from the compass, in *the direction of* the sights, and let the tripod remain with

ing it, for the next day's observation; on the next day, en the sun is at the same number of hours, or nearly so, n the meridian in the forenoon, as it was in the afternoon he last observation, adjust the instrument, and make an ervation as before, and if the stake should not fall in the ction of the sights, as in the previous afternoon's obser- ion, you will place another stake at the same distance n the compass as the first, in the direction of the sights. ill now be necessary to set a stake half way between the , and turn the sights to bear upon it; this is the direction sights of the compass will have when all the adjustments made.

t will now be observed, that the sun's image on the silver e, is a little too high or too low for the horizontal lines, amount of which may be very nearly estimated, by lines made to embrace the sun's image, which are thirty- minutes apart, and the tripple lines below these are five utes apart. Or the declination may be so changed on declination arc, as to bring the sun's image precisely be- en these lines, and the amount of this change will show many minutes the silver plates must be moved up or n, which is also the amount of the index error, in the de- ation arc, and this index error can be allowed in all sub- ient observations, instead of moving the silver plates to it out, as hereafter directed.

Having thus determined the amount of the index error, see the sun's declination is correctly set off, on the declina- arc, then loosen the three small screws to the silver e, and carefully move it up or down, as the case may re- e, until the sun's image is embraced between the lines, screw it fast. The number of minutes the silver plate



or in its declination arc, will sight too far to the east in the forenoon, and the reverse of it in the afternoon the mean between these two observations, is the the compass sights will take when the index error arc is corrected ; hence the *great importance* of carefully attending to this adjustment, and repeating it as often as suspicion that the instrument has undergone any from use or otherwise.

sun be obscured by clouds while any of the above ed observations should have been made, the same deferred to the next clear day, with equal prospects ssful results.

How to adjust the second Silver Plate.

far only one of the silver plates for the sun's image, adjusted, the other is easily brought into adjustment ws :

ff the declination at 0 or zero, place the instrument ripod, with the sights north and south, or nearly so, np it on the ball and socket, then turn the lens before the sun, the sun's image will now fall as much above w the lines on the adjusted plate, as his declination north or south. Keep the compass level, in an east t direction, but tilt or tip the instrument in a north direction, as the sun may have north or south declituntil his image is embraced between the lines on the late ; then by reversing the ends of the revolving ing the other lens towards the sun, and the unadjusted late to receive its image, taking care in making this , that the compass remains perfectly stationary ; if 's image falls between the lines on this plate, it is it if not, the plate must be moved up or down, as the y require, and as directed for the adjustment of the

first plate. This reversal should be repeated several
to see if the sun's image falls precisely between the lin
both silver plates. This being done, their parallelism
perfect as necessary. This adjustment may be made a
hour of the day, and if the first plate has been left unadj
or with an index error as before observed, the last plat
also have the same error, when they will reverse corr
and must be allowed for, as on the other plate, in all
quent observations.

How to adjust the Latitude Arc.

The latitude arc may have an index error, and ma
read the true latitude of the place of observation; but
of no consequence, as the latitude given by the instru
will be the latitude to be used in all observations, for fi
the variation of the needle, or running lines by the
Compass.

One way to find this index error is, to take the instru
to some place where the latitude is known, and by an
vation find what latitude is given by it, the difference, i
is the index error on the latitude arc, and may be used
the correct latitude in any other place.

How to adjust the Hour Arc.

The hour arc may also have an index error. To fin
the solar apparatus must be set for the true meridian
when the sun comes to the meridian, so place the revo
limb, that the sun's image will fall precisely within the
square on the silver plate formed by the horizontal an
tical lines drawn upon it, and observe how much on
of the revolving limb, over the hour arc, is one side, i
of the zero point; and as much as it is one side of that
so much must be allowed on the same side, for all subse
observations for other hours of the day, which will of c

solar time, and may be reduced to mean time by adding or btracting the sun's equation for the time being.

How to adjust the Compass sights to the Meridian.

The compass sights may need some adjustment. It has en stated that when certain adjustments have been correct- made, the sights of the compass will take one direction ly, when the solar apparatus is used. It should be men- oned, that this direction may not coincide precisely with e true meridian. The difficulty of planting the various rts of the solar apparatus by the instrument maker, is pro- bly the cause of this error, and to correct which, a true eridian line is necessary. To make this line, the method commended by the Surveyor General of Ohio, Indiana and ichigan, also by the Surveyor General of Wisconsin and wa, in their general instructions to deputy surveyors, will found convenient, which is nearly the same as that given Flint, and some other authors, in their work on surveying, find the variation of the needle.

Having established a meridian line, place the compass up- it, and by a careful observation with the solar apparatus, e if the direction of the sights coincides with it; if they do t, one of the sights on the compass plate should be moved til it will range with the other on the line of the true me- dian; this may be done by enlarging the holes of the screw d steady pins of the sight, with a suitable file, the way the hts require to be moved, just enough to bring them to nge on the line of the meridian, and screw the sights fast this position; the vacancy on the side of the steady pins, ay be filled up with copper or brass, not magnetic.

Second method.

A second method of correcting this error, is to unclamp

the compass plates, and keep the upper plate stationary, the lower, with the sights, are turned into the true mer then clamp the plates fast again. It will now be seen l verniers on the upper, and the graduated ring on the plate, the number of minutes the compass sights were the true meridian, and this amount of index error must lowed on all courses run by the instrument, if it is nc rected in the sights as first mentioned.

Third method.

I will here give another method of bringing the co sights to coincide with the true meridian, although I c recommend its use only to a very limited extent; but bring to view what ought to be known to every person a Solar Compass—it is this; If one end of the level under the hour arc, is raised or lowered by the screws end of it for that purpose, the direction of the sights v permanently changed, when the solar apparatus is us proportion to the change of the level; by this mea sights may be brought into the true meridian.

But this method throws the compass plates a little level when in use, and consequently the sights out of pendicular. This should put the surveyor on his against any alteration in this level, after the instrume been well adjusted.

How to adjust for an observation on a Star.

It now remains to be shown how the variation needle may be found, by an observation on any of th ble planets or fixed stars, when their declination do exceed 23½ degrees N. or S.; also, by the sun when v but so far obscured by clouds or fog, as not to give an *through* the lens. And here I shall suppose the obse

e a Solar Compass, adjusted as before directed, and one her additional adjustment will now be necessary.

Place the instrument on the tripod and set the movable mb that holds the lenses at 0 or zero, on the declination c, then so tilt the compass that this limb will revolve near- horizontally; then set a stake three or four chains from ie compass, with a strip of white paper about one inch wide stened around it, and nearly on a level with the instru- ient; the brass plates that hold the lens should now be rned to range on the stake, by means of the revolving mb; then range by the upper edges of these plates, and lter the position of the compass, if necessary, to bring their nge precisely upon the paper; then reverse the brass lates, by turning the revolving limb half around, taking re that the compass remains stationary; then range by eir upper edges as before. If they range above or below e paper on the stake, the highest plate must be filed down the top, by a fine file, until by reversals as before, they ill range both ways on the paper. This adjustment is ne- ssary to get rid of any index error in the declination arc, hen an observation is made without using the lens. The lar Compass will seldom be found incorrect in this respect, t it would be well to bring them to a test of their accura- .

To find the variation of the needle by a Star.

Thus prepared, the observer will select from a nautical manac, a planet or fixed star, that has not more than 23½ grees declination, and that will not be nearer than two urs of the meridian, at the time of the contemplated obser- tion, which may be known by their right ascension, &c. t off the star's declination thus selected, on the declination c, and adjust the latitude arc to the latitude of the place.

The time having arrived for an observation, place the pass on the tripod, as directed for an observation on the the observer will then turn the brass plates, to range in t rection of the star, by the revolving limb. If the star certainly known by the eye, bring one end of the revc limb over the hour and minute, the star is from the mer on the hour arc, (before or after, as the case may be,) by a range on the upper and out edges of the brass p will direct the eye to the star intended, or nearly so. V making these observations, an assistant should hold a li candle a little behind and above the head of the observ such a manner that the upper edges of the plates ca clearly seen, and yet not so bright as to obscure the star

If the upper edges of the plates range a little abo below the star, turn the whole instrument on the bal socket, the right way to bring the range precisely up and when done, the variation may be read off from the n

The observer would do well, if time permit, to selec stars; one before, and the other after meridian, and two observations, taking the mean between the two, (if should be any difference,) for the true variation of the dle.

By the Sun when partly obscured by clouds.

An observation in like manner can also be made o sun's lower limb, when partly obscured by clouds or fo the same purpose, by increasing the sun's declination, south, or diminishing it when north, the amount of the semi-diameter, and so set it off on the declination arc make an observation in the same manner as before dir on a star, by ranging on the upper edges of the plat *the sun's* lower limb.

Small sight vanes will hereafter be made in the out

of these brass plates, which may be used instead of ranging by their upper edges, as above described.

By the Moon.

Under favorable circumstances, an observation may be made on the moon, in the same manner as above described on the sun, to find the variation of the needle. But the observer must rightly estimate and allow for the effects of the moon's refraction, and parallax in altitude, upon the instrument; and on the account of the rapid change of her declination, great care should be taken to have it correctly set off on the declination arc, for the time of making the observation.

Effects of Refraction.

I would here remark, that the refraction of the rays of light, passing from the Heavenly bodies, effect the Solar Compass a little, in all observations to find the variation of the needle, and must be allowed for, when large enough to make a perceptible difference on the instrument. To accomplish this object by the sun, one of the compass sights is marked and figured on the inside with the sun's refraction in altitude, which may be seen and read, by turning the other sight to the sun, (when the instrument is leveled on the tripod,) in such a manner that the sun's shadow from the top of it will fall on the marked sight, at which place read the sun's refraction in minutes of a degree.

Although the effects of refraction on the Solar Compass can hardly be discovered, when the sun is two hours above the horizon, it will be useful to give the following proportions of refraction, thus found, to be allowed as hereafter directed, in two latitudes, which will enable the observer to make a right allowance in other latitudes.

In latitude 45 degrees, proportion of refraction to be al-

lowed, when the sun is three hours from the meridian, fo
fifths; four hours, three fourths; six hours, two thirds.
latitude 39 degrees, proportion of refraction to be allowe
when the sun is three hours from the meridian, three fourt
four hours, two thirds; six hours, one half.

And I would add, that at the equator, refraction entire
ceases to effect the instrument, except to find the appare
time. But at the poles ofthe earth, all of the refracti
should be allowed.

The above proportions are sufficiently correct for practic
purposes, and should be allowed on the instrument, by l
ting the sun's image drop below its true place on the silv
plate, and the number of minutes allowed can be seen
the tripple lines, drawn below the lines which embraces t
sun's image, in ordinary observations. These lines are fi
minutes apart, as before observed. The Solar Compass ca
not be relied upon as accurately giving the variation of t
needle between the hours of 11 A. M., and 1 o'clock, P. M
and all observations during this interval, (except for la
tude,) may be more or less imperfect, according to the d
tance of the sun from the meridian.

It is, therefore, advisable, between the hours of elev
and one o'clock, to use the needle at the variation last foun

Effects of the diurnal variation of the needle.

The diurnal variation of the needle may lead to much e
ror when running lines from points where its declinati
has been sometime previously found. It has been asce
tained by numerous observations, that this diurnal variati
is much more in the summer than in the winter months, a
the amount of these aberrations are more or less on differe
days of the same season of the year; but the order in wh
this change comes about, can be a little more clearly de

The north end of the needle will arrive at its most eas-
declination, between one and two hours after sun rise;
ill then gradually move westerly, until one or two
ck, P. M., soon after which, it will gradually decline
ard, and will return about half way back, at sun set,
e it was in the morning, and arrive at its most easterly
nation again the next morning between one and two
after sun rise.

The following observations were made by myself, in latitude 42 degrees 42 minutes north, near Detroit, in July, 1839.

1839.	Thermometer.			Weather.	Weather.	Wind.	Magnetic Variation.		
July.	5½ A. M.	1 P. M.	6½ P. M.	A. M.	P. M.		5½ A. M.	1 P. M.	6½ P. M.
13	60	79	62	clear,	light showers,	W. S. W.	1° 42′	1° 28′	1° 42′
14	59	72	67	clear,	flying clouds,	N. W.	1 42	1 26	1 33
15	56	73	64	cloudy,	light showers,	N. W.	1 32	1 28	1 28
16	55	71	66	cloudy,	some cloudy,	West.	1 38	1 28	1 30
17	52	80	69	clear,	clear,	W. N. W	1 30	1 28	1 30
18	55	85½	83	clear,	clear,	West.	1 41	1 28	1 35
19	56	89	82	clear,	flying clouds,	S. W.	1 40	1 28	1 35
20	63	80	74	clear,	cloudy,	S. S. W.	1 40	1 25	1 35
21	70	82	77	clear,	cloudy,	South.	1 42	1 28	1 30
22	72	86	75	cloudy,	some cloudy,	West.	1 40	1 28	1 35
23	65	88	77	clear,	clear,	East.	1 41	1 23	1 36
24	72	86	77	rain,	clear,	W. S. W.	1 43	1 25	1 35
25	69	83	80	clear,	clear,	N. W.	1 41	1 15	1 32
26	66	88	79	clear,	cloudy,	West.	1 40	1 23	1 35
27	69	80	76	clear,	shower,	West.	1 41	1 30	1 37
28	64	86	80	clear,	clear,	West.	1 42	1 24	1 30

By inspecting the above table, it will be seen that the va-
tion of the needle, sometime previously found at any place,
not be relied upon to run the line with; hence the neces-
y of knowing its variation at the time the line is being run.

guard against errors of this kind, the surveyor would do
ll, at the end of each line or point where the variation of
e needle is found, and a line to be run from it at some fu-
e day or hour, to take a bearing on some object in the
ection of his line if it can be had, if not, on some other
ject, and make a note of the same. On resuming his
rk, he can (if the sun should be obscured by clouds so as
prevent finding the variation of the needle,) observe the
me bearing again, and the difference in its course, if any,
the diurnal change, and must be allowed for on the course,
extending the line.

Local causes, also, so frequently change the direction of
e needle that it is not safe to extend a line far without an
servation to find its declination, and it will frequently be
nd that a little delay for this purpose will more than com-
sate for all the supposed advantages of running the line
thout it.

Commencing and executing surveys.

In all surveys made with the Solar Compass, the latitude
the starting point should be determined by the same instru-
nt with which the survey is to be executed, and the sur-
yor should remember that in running any other than an
st and west line, he is continually changing his latitude,
d that every ninety-four chains of northing or southing,
ll change his latitude one minute of a degree, or 5 minutes
d 12 seconds for six miles, and a corresponding change
latitude must be set off on the latitude arc for any other

distance, when an observation is made, to find the variati of the needle or for running lines by the solar apparatus.

How to compensate for difference of latitude.

To expedite business however, the following adjustm and method of compensating for the changes of latitude one minute has been successfully practiced.

At or near noon, set the Solar Compass for an observatio and see that the sun's image falls precisely between t lines on the silver plate, then alter the declination on t arc one minute, then by means of the leveling screws at t ball and socket, bring the sun's image between the lines the plate again, and observe how much the bubble has m ved in the N. and S. or latitude level, to make one minu difference of latitude, and mark the same on the edge of t opening; this should be done both ways from the middle the opening, and when done, it may be used for a change latitude, instead of so frequently setting off the difference latitude on the latitude arc. During the progress of a s vey, the surveyor should, if the weather permit, make observation every day at noon, to see if his latitude is rig and it is very important to a good observation, between t hours of nine o'clock A. M. and three o'clock P. M., to ha the latitude very accurately set off on the latitude arc.

Where the country to be surveyed is open, and t weather permits, it is best to run the lines by using the so apparatus instead of the needle, thereby avoiding all cau that affect the direction of the latter.

Directions to purchasers of Solar Compases.

Inasmuch as certain proportions, adjustments and fixtu are indispensable to a good Solar Compass, I will point th *out,* and leave the purchaser to apply the same, to any *strument of this kind.* In doing this, I cannot do better th

the proportions, &c., of the improved Solar Com-
ɔferred to in the preceding pages, while treating of
ɜtment.

latitude arc has a radius of five inches, and its divi-
every fourth of a degree, and has a vernier, that
› minutes.

declination arc has a radius of four and three fourth
and its divisions and vernier reads the same as on
tude arc.

lenses have a focal distance of about five and one
inches; consequently the brass plates that hold the
are the same distance apart. An observation on the
ıuld be made, to see if the lenses give a clear and
fined image of the sun, without any penumbra about
ıe silver plate. The silver plates are attached to the
lates by three small screws to each, and are movable,
own, for the purpose of adjustment. The revolving
ın which these fixtures are placed, turns on a male
ıale centre, about one and three fourth inches long,
ıut three eighths of an inch in diameter, and does not
, as in some instruments, on a circular arc, for its
movement.

hour arc has a radius of two and a half inches, and
ed into half degrees.

tube spirit levels, three and three fourths inches long,
ɔut three eighths of an inch diameter, are placed on
per plate of the compass, at right angles with each
ınd may be adjusted by means of screws at the end of

amp is attached to the socket of the compass, to keep
ıer plate, with the solar apparatus, from moving, while
hts, with the lower plate, are turned in any direction

the line require to be run. The upper plate is also divid on its edge, to every five degrees of a circle, and has a br centre pin, rising a little above the needle box; by this rangement the surveyor can readily see the approxim course of any object in view, without turning the sights its direction.

A small hole is made in the side of the compass box, ne the north end of the needle, also in the edge of the upp plate, under the glasses, over the verniers, to let off, evaporate the sweat or moisture that may accumulate und these glasses, and obscure a clear reading of their division these holes may be stopped with paper, which will gener ly absorb the sweat, but if it does not, unstop the holes, a turn them a little upwards, and the dampness will disapp in a few minutes. The above proportions and fixtures, perience has proved to be necessary to a good Solar Co pass; and these proportions ought not to be diminished, may be enlarged with some advantage in point of accu cy.

Report of a Committee of the Franklin Institute.

COMMITTEE ON SCIENCE AND THE ARTS.

REPORT ON WM. A. BURT'S SOLAR COMPASS.

The Committee on Science and the Arts, constituted by Franklin Institute of the State of Pennsylvania, for promotion of the Mechanic Arts, to whom was referred examination a Solar Compass, invented by WM. A. BU *of Mount Vernon, Michigan*: REPORT,

That they have examined the instrument of Mr. Bu *which is a modification* of that for which he received t

cott's Medal in 1835. The instrument in its principal rts has been already described. The improvements in- oduced by its inventor tend to render the instrument more mple in its use, and more permanent in its adjustments. he method is susceptible of any degree of accuracy disired. the model submitted to the committee, which was the orkmanship of Mr. Wm. J. Young, the principle of rever- n is applied throughout, and serves to remove all danger index error in any of its adjustments. In a clear day, in latitude not yet determined, this instrument, without the e of a telescope, is adequate to the determination of lati- le within two minutes, and differences of latitude perhaps one minute. The line of sight being brought in the di- ction of an object, and the instrument adjusted for the sun's tual declination, and the latitude of the place, (determined a previous culmination of the sun with this instrument,) e exact azimuth from the true north or south is read, and e reading of the compass is of no further use than to serve a check to the comparative azimuths determined astro- mically, and also to furnish a permanent record of the va- tion of the compass for the particular station. The in- ument is simple in its construction and use—requires, hen properly understood, no inconvenient expenditure of me—and in districts abounding in magnetic iron ore, is al- st indispensable. It seems to be a very important im- ovement over the ordinary surveyor's compass, and de- rving of great commendation. Above all, the committee nnot omit to mention the exceeding value of surveys made th this instrument, in fixing the variation of the compass, d thus furnishing, besides the particular result, viz : the undary and contents of the field or plot, the permanent

record also of the magnetic variation. When such result are increased, and the instrument more generally used which its intrinsic merit fully warrants, a most important addition will be made to the stock of our knowledge on this highly useful element, viz: the magnetic declination and its periodical changes in a great variety of localities.

By order of the Committee.

WILLIAM HAMILTON, *Actuary.*

Philadelphia, Dec. 14, 1840.

SURVEYOR GENERAL'S OFFICE,
Cincinnati, Dec. 7, 1840.

I have seen and examined Burt's "*Solar Compass,*" invented by William A. Burt, Esq., of Michigan, and consider it a very important and valuable improvement in the surveying compass. It has been in use in the survey of the public lands in this surveying district, for the last three or four years, by Mr. Burt and several others of my deputy surveyors, and is found to be much superior to the compass in common use; and I take great pleasure in recommending it to all who feel an interest in the advancement of science.

E. S. HAINES,
Surveyor General.

I have examined Mr. Burt's Solar Compass, and fully concur in the opinion of it above expressed.

SAM'L WILLIAMS.
Chief Clerk.