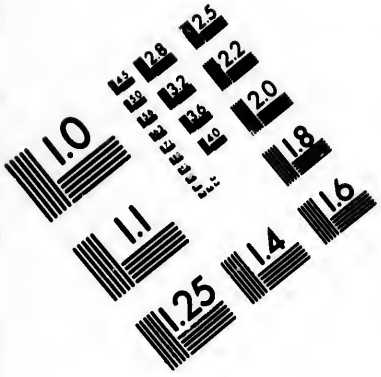

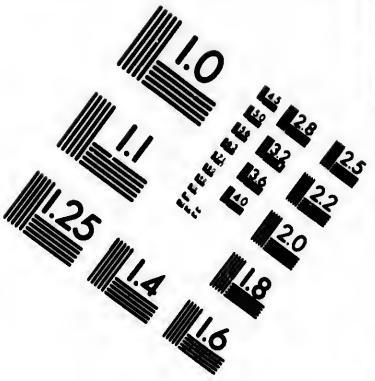

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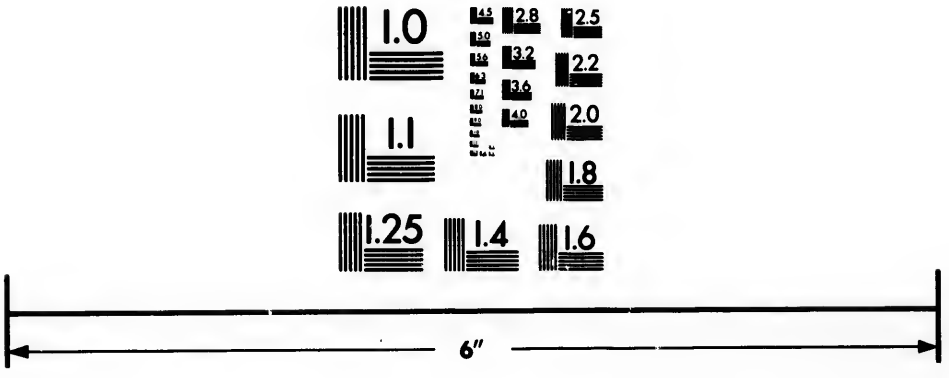

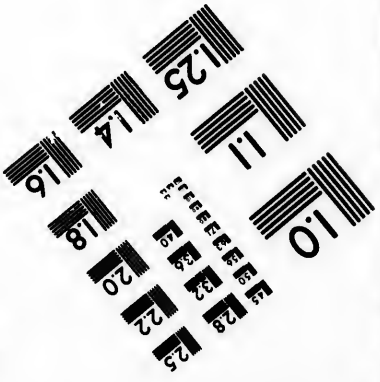

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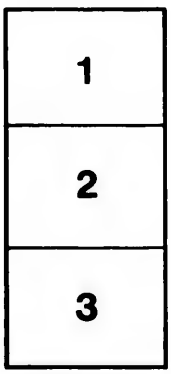

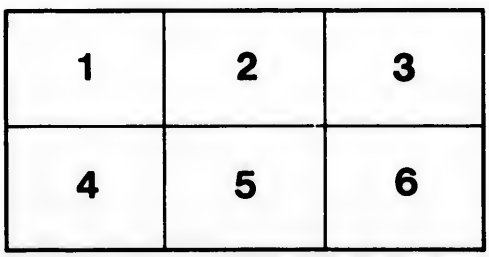

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NOTES

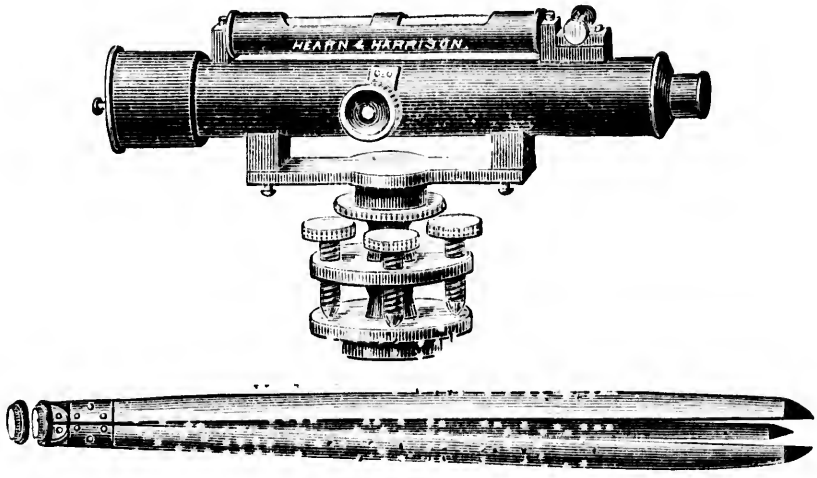
ON THE

ADJUSTMENTS OF THE DUMPY LEVEL

INCLUDING

FORMS OF FIELD BOOKS AND TABLES FOR REDUCING FRENCH AND ENGLISH MEASURE.

FOR THE USE OF SURVEYORS.



BY

W. McLEA WALBANK, B.A.S.

PROVINCIAL LAND SURVEYOR AND CIVIL ENGINEER.

MONTREAL, P. Q.

PREFACE.

THE object of the following remarks on the adjustments of the Dumpy Level is to enable Surveyor's Clerks and others who have not the advantage of a University education to understand how to test their instruments and make the necessary corrections without being obliged to purchase expensive works on the subject, or to depend upon the catalogues of the various instrument makers for their information, as it is seldom that the maker's adjustments are of practical use to the surveyor in the field. Hoping these notes may prove of interest.

I am,

Yours truly,

W. MCLEA WALBANK, B.A.S.,

P. L. Surveyor and Civil Engineer.

MONTREAL, P. Q.,
April, 1883.

HINTS TO STUDENTS.

It is of the greatest importance that the line of Collimation should be parallel to the bubble tube. For ordinary levelling operations it is not of such importance if these two are not exactly perpendicular to the vertical axis ; but t is essential that the bubble should be in the centre of its run when a reading is observed.

Always bring the centre of the lens on to the staff in reading.

In taking a series of important levels instruct the staff holder to move the staff gently to and fro, the least reading observed will be the correct one.

After reading the staff and noting the reading in your book, look to see that the bubble is still in the centre of ts run, and read once more as a check on the first reading.

Do not try to take longer sights than will admit of eading the staff distinctly.

Adjustments of the Dumpy Level.

The adjustments of a level may be divided into two classes: Temporary and Permanent adjustments.

The Temporary adjustments require to be performed with every change of the instrument, while in a well made instrument the permanent adjustments seldom become deranged, but ought nevertheless to be tested every time it is used (*i. e.*) each day.

TEMPORARY ADJUSTMENTS.

1st ADJUSTMENT.

To place the vertical axis truly vertical, which is commonly termed levelling the instrument, and is performed as follows:

Set up your instrument as nearly level as possible, by means of its legs or tripod. Set the telescope (which carries the spirit level) over two of the parallel plate screws, and bring the bubble to the centre of its run by means of these screws, then turn the telescope through 180 degrees. If the bubble remains in the centre of its run, the instrument

is in adjustment; if not, correct (½) one half the apparent error by the plate screws and the other half by the screws attached to the bubble tube, (I say "apparent error," because the bubble indicates double the true error when it is thus reversed end for end.) Turn the telescope (¼) one-quarter round on the vertical axis and bring the bubble to the centre of its run as before; now turn it another (¼) quarter, and the telescope will be over the same pair of screws as in the first instance. Again bring the bubble to the centre of its run and turn the telescope 180 degrees as already described. If the bubble does not now remain in the centre of its run, correct by the plate screws and the bubble tube screws in the same manner as already described. Keep on repeating the foregoing operations until such time as the bubble retains the centre of its run, while the instrument is being turned on its vertical axis through a complete revolution. The adjustment is then complete.

2nd ADJUSTMENT.

To correct for parallax or make the foci of the object glass and eye-piece coincide:

Move the eye-piece backwards and forwards until the cross-wires are seen distinctly, direct the telescope to some well defined object, and by means of the screws for that

purpose move the inner tube in and out until the image of the object is clear and sharp, and apparently coinciding with the cross-wires. Test your adjustment by moving your head from side to side and at the same time looking through the telescope. If the adjustment is complete the object will appear fixed, if imperfect the image will waver with the motions of the head. If the image appears to travel in an opposite direction to the movements of the head draw the inner tube out, if it moves in the same direction as the head it must be drawn inwards. This adjustment requires to be made anew for every object sighted to.

PERMANENT ADJUSTMENTS ARE:

FIRST

To place the cross-wires in the axis of the telescope tube. This is a complicated adjustment and belongs rather to the instrument maker in making the instrument than to the practical Surveyor, for it has been shown that the exact coincidence of the intersection of the cross-wires with the axis of the telescope is not essential to accurate levelling.

SECOND

To make the line of Collimation parallel to the bubble tube:

Select a tolerably level piece of ground, drive in three good solid pegs at equal intervals, say about 150 feet, set

up your instrument exactly over the centre peg. Perform the temporary adjustment as already described ; direct the telescope to a staff held on one of the pegs, focus and read it, taking care that the bubble is in the centre of its run and that no parallax exists, then direct the telescope to the staff held on the other peg, taking exactly the same precautions. The difference between these readings gives the difference of level between the top of the two pegs.

Now that we know the difference of level between the top of the two pegs, we also know the readings on each staff which is on the same level. Remove the instrument behind one of the pegs and place it in the same straight line as the two pegs and as close to one peg as will admit of its being focussed.

It now remains to make the line of Collimation ; trace a "level line" when the bubble is in the centre of its run. First read the staff nearest the instrument, and having got this, we know what the other staff ought to read if the line of Collimation is parallel to the bubble tube. Focus the the other staff and read it, if the reading on this staff is on the same level as the reading on the nearer staff, the line of Collimation is in adjustment, if not, get a reading on this staff on the same level by raising or lowering the Collimating or diaphragm screws, watching at the same time

that the bubble remains in the centre of its run. This may alter the reading of the near staff, so read it once more, and then read again the other staff. If the second reading on the further staff is on the same level as the second reading on the nearer staff the adjustment is complete, if not, continue repeating the above operation until two readings on the same level are obtained with the bubble in the centre of its run; when this is done the instrument is in perfect adjustment.

Or, if the instrument has no diaphragm or Collimation screws, having found the difference of level of two bench marks, as already explained, and shifted the level to a position beyond one of them, alter, if necessary, the inclination of the telescope by the plate screws, until the readings of the staves gives the true difference of level, and bring the bubble to the centre of its run by means of the screws attached to its end.

N.B.—Care should be taken to see that the telescope is screwed tightly to the horizontal bar before commencing the permanent adjustments.

The following are the forms of Field Book generally used by surveyors. In my own practice I always use the first form, it being in my opinion the easiest and most complete method of keeping field notes.

(First Form.)

"GRAND MERE FALLS." LEVELS FOR THE "CANADA PULP FACTORY."

March 3rd, 1883.

Stations	Dist'nce	Back Sight.	Inter-mediate	Fore-Sight.	Height of Instrument	Reduced Level.	REMARKS.
						67·20	B.M. on Crib lower end marked in red chalk.
		1·27			68·47		
				10·08		58·39	
		1·30			59·69		
			9·57			50·12	On Surface Water lower end.
				0·60		59·09	
		10·18			69·27		
				3·61		65·66	
		7·82			73·48		
			2·35			71·13	(given Mr. Battle.) B.M. Lower cut Cold Chisel mark
				0.14		73·34	B.M. on Stone, Head of Lower
		10·58			83·92	78·65	on supposed B.M. Excavation.
			7·21			76·71	Red arrow on centre line Lower
			3·58			80·34	Bench of end of Upper Section
				0·88		83·04	Upper Section.
		13·68			96·72		
				0·47		96·25	
		11·86			108·11		
				0·64		107·47	
		8·65			116·12		
			12·50			103·62	mark (given Battle.) B.M. on Upper Section Cold Chisel
				5·52		110·60	B.M. on Guard Wall.
		2·19			112·79		
				10·19		102·06	
		1·36			103·96		
				12·81		91·15	Surface water on new Centre Line Mar. 3
		68·89		44·94		67·20	
		44·94					
		23·95				23·95	

(Second Form.)

Dist'nce	Station O	Back Sight.	Inter-mediate.	Front Sight.	Rise	Fall.	Reduced Level.	REMARKS.
	No. 1						100·00	B.M. on S. W. corner of house at cross-roads.
		1·20						
100				9·10		7·90	92.10	
		1·70						
130			4·30			2·60	89·50	
390				9·60		7·90	84.20	
570		1·10		8·70		7.60	76.60	
		1·00						
720			5·20			4.20	72·40	
890	No. 2			9·60		8·60	68·00	B.M. on parapet of bridge over stream.
		8·90						
1040				1·10	7·80		75·80	
		9.10						
1190			4·30		4·80		80.60	
1360				3·10	6.00		81·80	
		8·70						
1510				1·90	6·80		88·60	
		6·20						
2670	No. 3			4·20	2·00		90·60	B.M. on large stone junction of fences.
							9·40	
		37·90		47·30			100·00	
				37·90				
				9·40				

Lineal English Feet to French Feet.

Eng. Feet.	Units.	Tens.	Hundreds	Thousands.	Tens of Thousands.
1	0·94	9·38	93·83	938.29	9382·93
2	1·88	18·77	187·66	1876·59	18765·86
3	2·81	28·15	281·49	2814·88	28148·79
4	3·75	37·53	375·32	3753·17	37531·72
5	4·69	46·91	469·15	4691·46	46914·65
6	5·63	56·30	562·98	5629·76	56297·58
7	6·57	65·68	656·81	6568·05	65680·51
8	7·51	75·06	750·63	7506·34	75063·44
9	8·44	84·45	844·46	8444·64	84446·37

3820 English Feet, how many French Feet?

3000	=	2814·88
800	=	750·63
20	=	18·77
Eng. Feet 3820	=	3584·28 Fr. Feet.

Lineal French Feet to English Feet.

Fr. Feet	Units.	Tens.	Hundreds.	Thousands.	Tens of Thousands.
1	1.07	10·66	106·58	1065·77	10657·65
2	2.13	21·32	213·15	2131·53	21315·30
3	3.20	31·97	319·73	3197·30	31972·95
4	4.26	42·63	426·31	4263·06	42630·60
5	5.33	53·29	532·88	5328·83	53288·25
6	6.39	63·95	639·46	6394·59	63945·90
7	7.46	74·60	746·04	7460·36	74603·55
8	8.55	85·26	852·61	8528·12	85261·20
9	9.59	95·92	959·19	9591·89	95918·85

1082 French Feet, how many English Feet?

1000	1065·77
000	000·00
80	85·26
2	2·13
French Feet 1082	1153·16 **English Feet.**

"SUPERFICIAL"

FRENCH ARPENTS TO ENGLISH ACRES.

Arpents.	Units.	Tens.	Hundreds.	Thousands.	Tens of Thousands.
1	0·84	8·45	84·49	844·85	8448·51
2	1·69	16·90	168·97	1689·70	16897·02
3	2·53	25·35	253·46	2534·55	25345·53
4	3·38	33·79	337·94	3379·40	33794·04
5	4·22	42·24	422·43	4224·26	42242·55
6	5·07	50·69	506·91	5069·11	50691·06
7	5·91	59·14	591·40	5913·96	59139·57
8	6·76	67·59	675·88	6758·81	67588·08
9	7·60	76·04	760·37	7603·66	76036.59

REMARKS.

In a farm or lot of 3198 Arpents, how many Acres?

	3000 =	2534·55
	100 =	84·49
	90 =	76·04
	8 =	6·76
Fr. Arpents	3198	2701·84 Eng. Acres.

"SUPERFICIAL"

ENGLISH ACRES TO FRENCH ARPENTS.

English Acres.	Units.	Tens.	Hundreds.	Thousands	Tens of Thousands.
1	1·18	11·84	118·36	1183·64	11836·41
2	2·37	23·67	236·73	2367·28	23672·82
3	3·55	35·51	355·09	3550·92	35509·23
4	4·73	47·35	473·47	4734·56	47345·64
5	5·92	59·18	591·82	5918·21	59182·05
6	7·10	71·02	710·18	7101·85	71018·46
7	8·29	82·85	828·55	8285·49	82854·87
8	9·47	94·69	946·91	9469·13	94691·28
9	10·65	106·53	1065.28	10652·77	106527·69

REMARKS

A field contains 3,551 English Acres, how many French Arpents does it contain?

3000	3550·92
500	591·82
50	59·18
1	1·18

Eng. Acres 3551 = 4203·10 Fr. Arpents.

"Excavation and Embankment."

Earth transferred from excavation to embankment loses from one eighth (⅛) to one tenth ($\frac{1}{10}$) of its volume. Rock increases its bulk or volume when broken by about (⅓) one third.

"Masonry."

One toise = 72 French Cubic Feet.
" " = 87·16 English " "
One quarry toise = three (3) toises of Masonry.