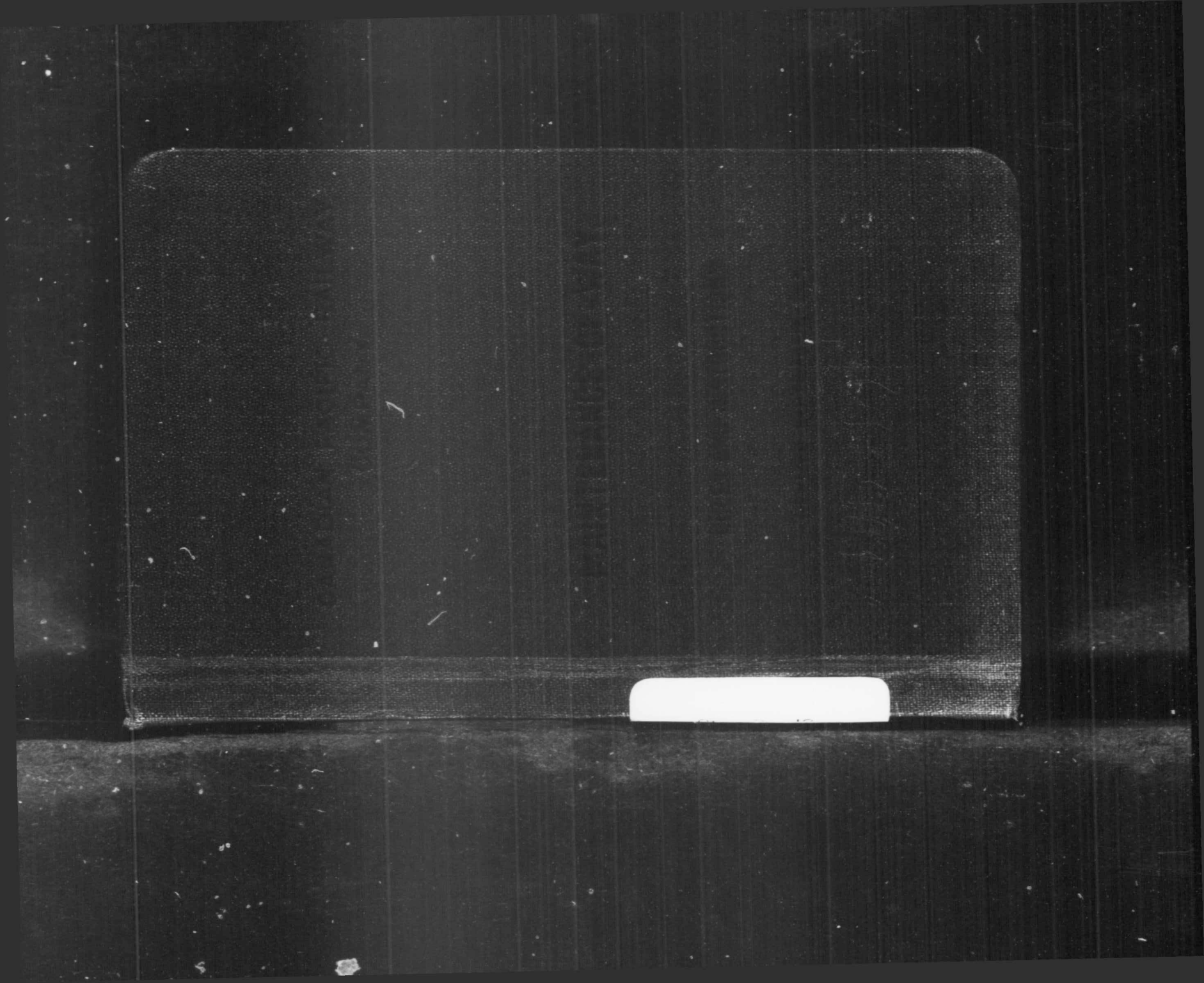

Alex Ferguson
1914

CANADIAN PACIFIC RAILWAY COMPANY.

MAINTENANCE-OF-WAY.

RULES AND INSTRUCTIONS.

REVISED SEPTEMBER, 1913.

CANADIAN PACIFIC RAILWAY COMPANY

MAINTENANCE-OF-WAY

RULES AND INSTRUCTIONS

IN EFFECT, JULY 1st, 1902

REVISED NOVEMBER, 1907
REVISED SEPTEMBER, 1913

The following Rules and Instructions are issued for the information and guidance of Maintenance-of-Way employees. They supersede all previous instructions inconsistent therewith.

Signed
J. G. SULLIVAN
Chief Engineer,
Western Lines.

Signed
J. M. R. FAIRBAIRN
Assistant Chief Engineer,
Eastern Lines.

Approved
GRANT HALL
General Manager,
Western Lines.

Approved
A. D. MACTIER
General Manager,
Eastern Lines.

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GENERAL NOTICE.

To enter or remain in the service, is an assuran
of willingness to obey the rules.

Obedience to the rules is essential to the safe
of passengers and employees, and to the protecti
of property.

The service demands the faithful, intelligent, a
courteous discharge of duty.

To obtain promotion, capacity must be shown f
greater responsibility.

Employees, in accepting employment, assume i
risks.

Accidents must be avoided, and all employe
must do all in their power to prevent them, eve
if in so doing they perform the duty of someon
else.

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GENERAL RULES.

A. Every employee whose duties are prescribed by these rules, must have a copy of them accessible when on duty.

B. Employees must be conversant with the rules and special instructions and obey them. If in doubt as to their meaning, they must apply to proper authority for an explanation.

C. Employees must pass the required examinations.

D. Persons employed in any service on trains are subject to the train rules and special instructions.

E. Employees must render every possible assistance in their power in carrying out the rules and special instructions.

F. Any violation of the rules and special instructions must be reported.

G. The use of intoxicants by employees, while on duty, is prohibited. Their use, or the frequenting of places where they are sold, is sufficient cause for dismissal.

H. The use of tobacco by employees when on duty in or about passenger stations, or on passenger cars, is prohibited.

I. Employees must be courteous and considerate in their dealings with their fellow employees and the public, and particularly so with passengers and other patrons of the Company.

J. Employees, on duty, must wear the prescribed badge and uniform, and be neat in appearance.

K. Persons authorized to transact business a stations or on trains, must be orderly and avoi causing annoyance to passengers.

L. In case of danger to the Company's property employees must unite to protect it.

M. Employees must always be vigilant to pro tect, and must promptly report anything detrimenta to the Company's interests.

N. Employees must, on leaving the service o the Company, return all property of the Company which may be in their possession, making good an loss or any damage done to it through misuse o neglect.

O. Supplies and material must be properly and economically used and cared for. Scrap and other material of value must be turned in to the Company.

P. Unless authorized to do so, employees must not receive or pay out money on the Company's account or use the Company's credit.

Q. All accidents involving injury to person, or damage to track, structures, or rolling stock, must be reported promptly by telegraph to the proper officer, and confirmed by mail. In case of injury to person, the names and addresses of as many witnesses as possible must be obtained.

R. An employee dismissed for cause, or leaving the service, must not be re-employed, unless with the sanction of the General Superintendent with whom last employed.

S. Persons previously employed on another railway, if given employment, must not be retained in the service of the Company unless satisfactory evidence in writing is obtained as to previous good record.

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T. Persons whose hearing, sight, or color perception is known to be defective, must not be employed in any capacity where such defect may endanger the safety of life or property.

U. Employees must devote themselves exclusively to the Company's service, attending during the prescribed hours, and residing wherever required. They must not, directly or indirectly, engage in any other business or trade without permission. Employees who are liable to be called upon for duty at any time, must keep the proper officer advised as to where they can be found.

V. Employees must not absent themselves from duty without authority; exchange duties with others or engage substitutes.

W. The giving of presents by employees to their superiors and the acceptance by employees of gratuities or rewards from patrons of the Company is prohibited.

X. The Company reserves the right to deduct from the pay of its employees, fees for medical attendance, and rents, where employees are its tenants.

Y. Employees must not subject the Company to the service of a Garnishee Order on their wages or assign their wages without permission. They must reimburse the Company for any expense thereby incurred.

Z. Cars must not be placed on the main track to be loaded or unloaded unless authorized by a train order.

AA. Wood, lumber, stone, or other material, must not be piled within six feet of the rails.

BB. Employees must familiarize themselves wi[th] one under the location of all structures and obstructions alo[ng] who must s the line that will not clear them when on top [or] turned to its side of cars or engines. JJ. Main

CC. The telegraph must not be used unless a[n]other switch visable in the Company's interests, and telegra[m]e points m must be as brief as possible consistent with cle[ar] proper po understanding. KK. If v

DD. Employees desirous of appealing to the he[ad] work should of the department must do so through the prop[er] tely neces officer. exercised in

EE. Those employed on sub-divisions that a[re] LL. Slow double tracked are in every instance, when steppi[ng] hen no lon out of the way of approaching trains, to move [on] MM. Wh the right of way, and not to the other track. For[ce] rack gauge men will be personally responsible for educati[ng] ars should their men to this.

FF. The use of hand, push, motor, and velocipe[de] cars for other than Company's business is forbidde[n] and no unauthorized person will be permitted to ri[de] on or operate the same.

GG. Station platforms, fences, tool houses, ove[r] head foot bridges, driveways, and grounds [at] stations and yards must be kept in good orde[r] and defects that might cause injury to perso[ns] promptly repaired.

HH. Care should be taken not to disturb eng[i]neers' stakes or monuments.

II. Unless to prevent accidents, maintenance o[f] way employees will not throw switches for trai[ns] 1. Roadm[a]men. Switches should not ordinarily be thrown f[or] ed and righ velocipedes, hand, or motor cars. When necessa[ry] ng everythi[ng] to throw switches for loaded push cars, it must b[e] erritories in

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one under personal supervision of the foreman, who must see that the switch is immediately returned to its proper position.

JJ. Main track switches must be locked and other switches secured. After a switch is turned, the points must be examined to know that they are in proper position.

KK. If work on track requires protection, the work should not be done during fogs unless absolutely necessary, when the utmost care must be exercised in protecting the track.

LL. Slow orders should be promptly cancelled when no longer necessary.

MM. When there are track circuits, insulated track gauges, velocipedes, hand, push and motor cars should be used.

ROADWAY RULES AND INSTRUCTIONS.

ROADMASTERS.

1. Roadmasters have charge of the track, roadbed and right-of-way and are responsible for keeping everything pertaining to the roadway on their territories in proper repair.

2. They must be constantly vigilant in the se of accid
spection of their territories, riding over them promptly
least once every week on the engine of the fast tches (Gen
passenger train, going over every section, eit ve the corr
walking, by hand car, or velocipede, at short int an at least
vals, and frequently visit all points where any n ntractors
or special works of repair are in progress. Th fety of the
must maintain a complete knowledge and cl quiry and
practical control of all works, employees and s accidents
plies under their jurisdiction.

3. They have charge of the sectionmen and oth dition of
laborers employed by the Company on roadw uses, cars,
work on their territories, and shall report th 9. They m
time in the manner prescribed. sued for the

4. In the appointment of Foremen, Roadmast d report an
must see that they are thoroughly practical, exp t come un
ienced, sober and trustworthy, of sufficient educat found of in
and intelligence to enable them to read and und er defects
stand these rules, the time tables and all writ ported at
orders, and to make accurate returns of the ti cause.
of the gangs, and of the material used on th 10. Track
sections, and other necessary reports. aster at the

5. They shall assign the duties to each Forem e date of t
in their charge, and must see that such duties a bble tubes
promptly and properly performed. 11. They

6. They must report any apparent defect mplete outfi
bridges, trestles, culverts or water supply. port all defe

7. They must see that the employees in th rm.
charge are provided with, and understand all ru 12. They
and instructions concerning their duties, includi w appliance
the meaning and use of signals; that materials a 13. On Au
safely kept and economically used, attend to t oadmaster m
removal of slides, snow or other obstructions; e main trac

se of accident, arrange for the necessary force promptly clear the road; they must use standard tches (Gen. Train & Interlocking Rules—No. 2), ve the correct time and compare with each Fore- n at least once a week; see that the work of ntractors and others does not endanger the fety of the road and make careful and prompt quiry and report fully on the prescribed forms accidents occuring on their territories.

8. They will be responsible for the neat and tidy ndition of station grounds, section and tool uses, cars, and other property in their charge.

9. They must be familiar with the instructions sued for the government of trains and trainmen, d report any neglect of duty or violation of rules t come under their notice. When any evidence found of injury to track from flat wheels or any er defects in rolling stock, the matter must be orted at once and every effort made to locate cause.

10. Track levels must be tested by the Road- ster at the beginning of the working season, and date of the inspection recorded. All sluggish bble tubes must be replaced. See also Rule 163.

11. They must see that all Foremen have a mplete outfit of tools in good condition, and will port all defective tools and material on the proper rm.

12. They will not permit experimental trials of w appliances without proper authority.

13. On Automatic Block Signal territory the adMaster must advise the Superintendent before e main track is ballasted, new rail laid, switches

put in or any changes or repairs made which wi
interfere with the signal system and which it
not the regular duty of the section foreman t
repair. Such advice to be given in sufficient tim
to permit of arrangements being made for th
working of the signal system with as little interrup
tion as possible.

SECTION FOREMEN.

14. Section Foremen will receive their instruc
tions from and report to the Roadmaster.

15. They must carry a reliable watch, and whe
practicable, compare time each day with the Com
pany's clock at the nearest telegraph station, o
with the conductor of a train or Foreman of adjoin
ing section.

16. They must have with them when at work
a copy of the current time-table, and must know
the time of all regular trains at all points of their
sections. They, with their men, on single track
must watch both sides of passing trains, on double
track they will watch only one side stepping off on
to the right-of-way and not on to the other track
and if any dangerous defect in the train is noticed
give the trainmen the stop signal and advise them
of the defect. They should give enginemen and
trainmen a slow signal when trains are following
each other closer than ten minutes.

17. They must personally engage in work, and
see that all employees in their charge perform their
duties, and recommend to the Roadmaster for dis-

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missal or discipline anyone guilty of neglect, incompetence or misconduct.

18. They have charge of the maintenance of track on their sections, and are responsible for its safety.

19. They must see that the track is in good line and surface, properly spiked and jointed, bolts kept tight and that it is in true gauge; that the cross ties are properly spaced, lined and tamped; that the roadbed is in good order; that the proper slopes and ditches are preserved or provided, and that the drainage is not interfered with.

20. They must test the gauge of track at least twice a month or oftener if there is any tendency of track to spread. Any indication of spread track must at once be corrected. See also Rule 142.

21. They must give special attention to points where obstructions are liable to occur; examine the slopes of cuts, and remove anything likely to fall or slide; remove combustible material from the vicinity of the track, fences, bridges and buildings; extinguish fires that occur along the road; see that fences are kept in order; remove sediment from water tanks; report any failure which they cannot remedy in the water supply, and report all overhead wires that are less than 25 feet above top of rail. They must render assistance in the case of accidents. During heavy storms they must go over their sections and take every precaution to prevent accidents.

22. They must not permit material to be placed at or near grade crossings where it will obstruct the view of approaching trains.

23. They must keep approaches and outlets t
waterways free from brush, driftwood, etc.

24. They must provide ventilation in enclose
water tanks. The lower sash in the upper windo
shall be kept open full height, except during th
winter months.

25. They must not permit the track to be ob
structed without first displaying stop signals, se
Rules 48 to 59 inclusive.

26. They will be responsible for the proper spik
ing, jointing, lining and gauging of the track o
bridges and trestles at all times, and they mus
report to the Roadmaster and Train Dispatcher b
wire, if necessary, any dangerous defect in surfac
or line. In case of defects of surface on smal
pile trestles, the Section Foreman, in the absenc
of Bridgemen, or in cases of emergency, shall cor
rect the surface by shimming under the rail, an
report the same.

27. They must see that the track about whic
contractors or others are working is safe for th
passage of trains at full speed, or proper signal
displayed.

28. They are responsible for the daily testing o
crossing alarm bells, in accordance with Orders o
the Board of Railway Commissioners, Nos. 5568 an
6452, which read as follows:—

(1.) "That every electric bell upon the line of an
railway company subject to the legislative authorit
of the Parliament of Canada, installed for the pur
poses of protection, be inspected every morning b
the Sectionman in whose division or section suc
bell is, and tested by placing a wire across the rail

upon each
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(2.) "Th
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upon each side of the crossing, or by establishing electric connection by any other device or method which will indicate whether or not the bell is in good working order; and that if the bell fails to ring, or rings continuously, a flagman at once be placed at such crossing, whose duty it shall be properly to protect the same until such bell is repaired; and notice of such non-repair be at once given to the Station Agent nearest to such bell, whose duty it shall be to report the matter at once to the department having charge of the operation and repair of such bells."

(2.) "That failure to comply with the provisions of this Order shall subject the defaulter to a fine of $50.00, payment of which may be ordered by the Board upon proof of the offence."

29. Section Foremen on Automatic Block Signal territory will maintain all bonding and insulated joints. They will receive instructions for the proper maintenance of same from the signal maintainer. In the event of other repairs being made to the Signal System by Section Foremen, advice of such repairs must be sent to the signal maintainer, stating nature and extent of such repairs.

30. They will immediately report by wire to "Chief Dispatcher" and defects or improper working of the Signal System.

31. The operations or material of Interlocking and Block Signal Plants must not be interfered with by trackmen. Repairs which require the removal of any signal apparatus must be made under the direction of the Signal Repairmen.

EXTRA GANG FOREMEN.

32. Extra Gang Foremen receive their instru
tions from and report to the Roadmaster, and
performing their special duties they must confor
to the rules and instructions for Section Foreme

TRACK WATCHMEN.

33. Track Watchmen receive their instructio
from and report to the Section Foremen.

34. They must carefully examine the track f
obstructions and see that it is in a safe conditio
Should any obstruction to the track occur, whi
they cannot instantly remove or repair, they mu
at once display stop signals in each direction (s
Rule 49), and advise the Section Foreman. (S
also Rule 326).

35. Night Watchmen, before going off dut
must notify the relieving Watchmen or the Sectio
Foremen of the trains due which have not passe
and of any other matters requiring attention.

CROSSING WATCHMEN.

36. Crossing Watchmen receive their instructio
from and report to the Section Foremen.

37. They must prevent persons and vehicles fro
crossing the track when trains are approaching, a
operate gates when they are provided.

38. They must use green signals to prevent pe
sons and vehicles from crossing the track whe
trains are approaching.

Red sign
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may be

Red signals must be used by them only when necessary to stop trains.

39. They must keep the crossings clean and change ways clear, and perform such other duties as may be assigned.

TRACK WALKING AND INSPECTION.

40. During heavy wind, snow and rain storms, and freshets, every precaution must be taken to prevent accidents, and each Section Foreman must go out with his men if necessary. Men going out to watch track, in storms or in ordinary track walking, must have with them signals to stop trains. During heavy rain storms, all waterways must be inspected, and all obstructions removed therefrom. (See also Rule 340.

41. Section Foremen on main lines must see that all parts of their sections are examined daily; on branch lines as often as directed in writing by the Roadmaster. This examination must be made by the Foreman, personally, where there is any liability of danger to the track, either from freshet or other cause; when no such danger is liable he will send an experienced trackwalker to examine the part of the section which the Foreman has not examined.

42. Trackwalkers must carry a spike maul, spikes and wrench or such tools as are most liable to be required, together with the signals to stop trains; they must examine the track, roadbed, frogs, switches, road-crossings, farm crossings, bridges, trestles, culverts, cattle-guards, fences and overhead

wires, and report promptly to Foreman any def
or obstruction which they cannot fully repair
remove, after protecting the point, if obstruct
by the prescribed signals.

43. They must drive live stock off the right-
way (where fenced), and close gates at farm cr
ings that may be left open, and report or rep
defective gates or gate fastenings. Gates frequen
left open should be reported to the Roadmaster

44. Section Foremen must personally inspect
whole of their sections at least twice a week,
oftener if so instructed by the Roadmaster, a
shall observe particularly the condition of the ma
track, switches and frogs, and make necessary
pairs.

45. Section Foremen must examine particula
the tops of piers and abutments, stringers a
girders, remove all chips and dirt, and keep wat
barrels filled. Special care must be exercised
prevent fires from extending to fences and adjo
ing property.

46. Trackwalkers must report, and Section Fo
men must replace, all main track rails which sh
breaks, cracks, splits and flaws, or other seri
defects.

47. Trackwalkers must report, and Section fo
remove any trees, rocks or other material wh
may be in danger of falling on the track.

SIGNALS.

48. The track must never be obstructed in a
way without first being protected by the pro
signals, as extra trains may pass over the road

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time. Any work that would interfere with the passage of trains at full speed is an obstruction. The track may be obstructed for making repairs to within fifteen minutes of the time of passenger trains, and ten minutes of the time of freight trains, but never without the protection of proper signals.

49. When the main track is to be obstructed for repairs or renewals, or by loaded push cars or otherwise, or an obstruction of the track is discovered, must send a flagman in each direction, a sufficient distance from the obstruction to insure full protection, at least:—

500 Yards, (10 Telegraph poles)	In daytime, if there is no down grade towards the obstruction within one mile, and there is a clear view of 2,000 yards (40 telegraph poles) from an approaching train.
1200 Yards, (24 Telegraph poles)	At other times and places, if there is no down grade towards the obstruction within one mile.
1800 Yards, (36 Telegraph poles)	If there is a down grade towards the obstruction within one mile.

50. The flagman must, after going back a sufficient distance from the obstruction to insure full protection, take up a position where there will be unobstructed view of him from an approaching train of, if possible, 500 yards (10 telegraph poles),

first placing two torpedoes (not more than 200 edoes place less than 100 feet apart) on the rail on the sa to make side as the engineer of an approaching train, lag. When yards (2 telegraph poles) beyond such position. T turn to as flagman must remain in such position until recall 55. A yel or relieved. he track o

51. Flagmen must always on the approach of n approachi train display stop signals, and, if not already do et distant place two torpedoes on the rail, as before describ les an hou and then return 100 yards (2 telegraph pole eed of a t nearer the protected point. reen flag or

52. Torpedoes must not be placed near statio the same public crossings or where persons are likely to g train, at injured by them. tes that fl

53. Flagmen must each be equipped for day ti A "SLOW with a red flag and four torpedoes, and for nig me side as time and when weather and other conditions obscu y be used day signals, with a red light, a white light, fo effect. torpedoes, three red fusees, and a supply 56. The e matches. otor cars

54. If impossible to thus protect the defecti ohibited. point in both directions, and perform the requir 57. Forem work, a red flag by day and, in addition, a r hich are ex light by night or when weather or other conditio ssing their obscure day signals, must, in the absence of a fla er the trac man, be first fixed, clear of passing trains, on t 58. Red, g same side of the track as the Engineer of ken for sig approaching train, and where it will be clearly nance of w his view, 1,200 yards (24 telegraph poles), if 59. Any d down grade, and, if there is a down grade with hich trains one mile, 1,800 yards (36 telegraph poles) from t ill not be defective point, or as much further as may cted by pro necessary to insure full protection, with two to Roadmast

edoes placed on the rails opposite each other so to make one explosion, 100 yards beyond the red ag. When this has been done, the flagman may urn to assist in the work.

55. A yellow flag or a yellow light placed beside he track on the same side as the Engineer of n approaching train, indicates that the track 3,000 et distant is in condition for speed of but six iles an hour unless otherwise instructed, and the peed of a train will be controlled accordingly. A reen flag or a green light, placed beside the track. n the same side as the Engineer of an approach- g train, at a point beyond the slow track, indi- ates that full speed may be resumed.

A "SLOW" sign placed beside the track on the me side as the Engineer of an approaching train, y be used to mark a point where a slow order is effect.

56. The explosion of torpedoes by hand, push, or otor cars and velocipedes, is dangerous and is rohibited.

57. Foremen and others must replace torpedoes hich are exploded, or removed from the rails when ssing their hand, push, motor cars, or velocipedes er the track where torpedoes are placed.

58. Red, green or yellow clothing may be mis- aken for signals, and should not be worn by main- nance of way employees.

59. Any defect in roadway or structures over hich trains should run at reduced speed, which ll not be repaired that day, besides being pro- cted by proper signals, must be reported by wire o Roadmaster or Bridge and Building Master,

giving location and character of defect. A du
cate of this report must be sent to the T
Dispatcher who will issue slow orders for tr
passing defective point. Roadmasters and Bri
and Building Masters must give defect so repo
immediate personal attention, so that slow or
may be cancelled as soon as possible.

ROADBED.

60. The Roadbed is the foundation of the tr
and upon its strength and permanence, depends
stability of the track.

61. The roadbed at sub-grade must be of
standard width, which for minor branch lines is
less than fourteen feet, and on main lines and
portant branches is not less than sixteen feet;
double track it should be not less than twenty-
feet in width.

62. To secure uniformity, Section Foremen
use standard roadbed and ballast templates, un
otherwise directed.

63. To be permanent the slopes of embankme
and cuttings, except in rock, should be flat eno
to readily admit of the growth of vegetation, wh
Section Foremen should encourage, in order t
the slopes may be permanently protected agai
the action of the elements.

64. Material used for roadbed repairs, tre
filling and other improvements, should, when p
sible, be taken from points where the removal
the same will benefit the roadbed by widening c
ditching, grade reduction or alignment impro
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65. The roadbed at sub-grade, as shown on the standard plans, should be crowned to facilitate its drainage by raising the centre four inches higher than the sides.

66. Narrow banks on curves should be widened to the standard width from track centres as established by the Engineer.

67. Slopes of cuts subject to slides, and all embankments along waterways subject to erosion by action of water or ice should be suitably protected.

68. On sections where the roadbed, ballast section line, gauge and drainage are up to the standard, a grass line must be maintained at the intersection of the standard ballast section and the roadbed.

DRAINAGE.

69. The worst enemy of the roadbed is *water*, and the further it can be kept away, or the sooner it can be diverted from the roadbed, the better the track will be protected.

70. Ditches in cuts must be dug uniformly and parallel to the track, in accordance with the standard roadbed cross section. They should be graded and enlarged so as to pass all water freely during heaviest storms, be deep enough to thoroughly drain the ballast and the surface of the roadbed, and where liable to scour be properly protected. All new ditches must be dug, and all old ditches cleaned before the advent of winter.

71. Surface water should be intercepted by surface ditches on the upper side of cuts when necessary or practicable.

72. When efficient side ditches in wet cuts can be maintained on account of the character of material or lack of space, the ditches and the road bed if necessary should be underdrained by means of stone or tile drains and the trench filled with gravel or cinders. They must be laid at such points and in such manner as directed by the Engineer.

73. Material taken from ditches or elsewhere must be used to reinforce narrow embankments when practicable or be deposited on the slopes of embankments below the ballast; it must not be placed on the tops or slopes of cuts as it is liable to be washed back into the ditches.

74. Covered cross drains should be put in wherever necessary; they must be placed deep enough and upon such grade as will thoroughly drain the ditch from which they lead. They must not be placed where slopes of embankments or sidehills will be washed away unless properly protected.

BALLAST.

75. Ballast is used to give perfect drainage, prevent upheaval by frost, to distribute the bearing of the ties, and insure a uniform support thereto.

76. In the selection of ballast, the volume and character of traffic, the climatic conditions, and the nature of the material in the sub-grade should be considered.

77. Broken stone ballast should be in accordance with standard specifications and be used as directed.

78. Gravel ballast will be used ordinarily. It should be clean, strong and not too coarse, and

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hrown on
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rack signs,

et cuts can uniform size and character. It should be free from
racter of t e sand, loam and clay, which will make dusty
and the roa rack, cause weeds to grow and will interfere with
ied by mea ainage. It should not contain large stones, for
h filled wi ey will cause rough riding track.
t such poi 79. The practice of mixing new ballast with old
Engineer. nsuitable material which was between and around
or elsewhe e ends of ties is prohibited.
bankments 80. Before new ballast is distributed, centre and
opes of en ade lines should be given by the Engineer, track
not be p ould be thrown to line, defective ties replaced,
liable to ies properly spaced, and all unsuitable material
above the bottom of the ties removed to the full
ut in wher idth of the roadbed and used to widen narrow
deep enou nbankments, according to the standard roadbed
ly drain t ction.
ust not 81. Avoid wasting ballast down the sides of em-
or sidehi bankments. Material for raising and ballasting
rotected. ust not be taken from the slopes of the em-
bankment to the reduction of the same below
standard.
82. Where there is heaving or soft track due to
lrainage, t et pockets in roadbed, a proper drainage outlet
the bearin ust be provided, if necessary removing the un-
rt thereto uitable material causing this condition.
olume an 83. The depth of ballast under the ties, for main
ns, and th ines and important branches, must be not less
should b han eight inches, and for minor branch lines it
should be not less than six inches.
accordan 84. Large stones unfit for ballast should not be
s directe hrown on the right-of-way, but used for blind
narily. drains at public and farm crossings, at the base of
se, and track signs, or buried at the ends of ties.

85. When re-surfacing or ballasting tra
through tunnels and snow-sheds or under over-he
bridges or alongside of water-tanks, freight
passenger platforms and coal chutes, the gener
surface of the track must not be raised except b
special instructions from the Engineer.

BALLAST SECTIONS.

86. The Standard Broken Stone Ballast Secti
should be used only for clean broken stone or sla
87. The Standard Coarse Gravel Ballast Secti
should be used only for clean coarse gravel, a
engine cinders.
88. The Standard Earth Ballast Section shou
be used for all material that will not drain freel
89. The Roadmaster will insure that the prop
standard ballast section is used for the differe
classes of ballast.
90. When ballasting is completed, the balla
must be trimmed to standard, the track must b
in perfect gauge, line and surface, and according t
the stakes furnished by the Engineer.

CROSS TIES.

91. Cross ties will be furnished in accordanc
with the standard specifications. (See Rule 296.
Cull ties must not be used in main lines, but wi
be used generally in sidings and spurs if sound an
otherwise fit for use.
92. Bark must be removed from all ties excep
Jack pine and tamarac before they are placed i
track.

93. Ties
inspected
by the sta
to "g".)
at joints.
94. Join
dard plans
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95. All
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96. The
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33 ft. rail
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30 ft. rail
be spaced
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98. Cros
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93. Ties must not be used unless they have been inspected and marked or stamped, as called for by the standard specifications. (See Rule 298, "a" to "g".) The best ties should be selected for use at joints.

94. Joint ties must be spaced as shewn on standard plans; the remaining ties must be spaced uniformly between the joint ties.

95. All ties must be laid and kept at right angles to the track.

96. The spacing of ties in main track will vary according to the size of the ties. The number per 33 ft. rail length will be from 15 to 18 and spaced as per Standard Plan. The average number per 30 ft. rail length will be 16. In sidings, ties will be spaced from 15 in. to 20 in. apart.

97. The ends of cross ties in single tracks must be lined true on the south or east side of the track. The distance from the lined end of an eight foot tie to the outer edge of the base of standard 85 lb. rail is 16 inches. A gauge notch should be cut in the spike maul handles for measuring this distance. On double track, the ties should be lined on the outside of each track.

98. Cross ties should never be notched, but if necessary must be adzed, in order to obtain a true uniform bearing for the tie plate or the base of the rail.

99. Every Foreman must keep in his hand-car house and with his gang a supply of wooden tie plugs, which will be provided on requisition. The invariable rule must be to plug every hole wherever

a spike is drawn, except where the tie is to b ment of th
renewed that season, and, when possible respil afely last
into the plug and not weaken tie by making a ne If three
hole. the Roadm

100. In moving new ties with a pick, the poi ties should
should be struck into the side of the tie and n No ties n
into the face. ties that ar

101. When new rails are laid and the joint subsequentl
thereby changed, the ties must be spaced to suit th 104. Sect
new joints. renewals in

102. There is probably no item in track wor me on for
where Roadmasters and Foremen can waste or sav The tie re
so much money as in selecting ties which are to b es marked
renewed. graph poles.

During the autumn of each year the Roadmaste 105. The
accompanied by the respective Section Foremen as early in
must walk over each section on his territory and the renew
make careful inspection of each tie in the track nd ballast
studying the local conditions, also the condition o 106. Road
the ties on either side of the tie under inspection moved fro
the amount and character of the traffic, and whe to see that
ther on straight or curved track. An estimat have remain
based on this inspection must be made of the num year.
ber of ties which will require renewal during th 107. The
following season. in the track

103. During the following Spring special inspec new ties no
tors must thoroughly inspect all ties in track and upport, on
mark on the face with a spot of red paint those which compe
to be removed. Care must be taken not to dis- double work, a
turb good ties when testing. Renewals should ound rail c
not exceed six ties per rail length in one rack if cut 1
season, excepting in exceptional cases on curves, be turned and
and no tie should be removed, which in the judg- the old tie-b

ment of the Roadmaster and Section Foreman, can safely last another year.

If three consecutive ties appear to need renewal the Roadmaster's opinion on the condition of the ties should be secured by the Foreman.

No ties must be removed from the track except ties that are marked for removal or ties that are subsequently broken.

104. Section Foremen must keep a record of tie renewals in the manner prescribed and report the same on forms provided for that purpose.

The tie renewal record must show the number of ties marked for renewal between each pair of telegraph poles.

105. The work of renewing ties should be started as early in the spring as the frost will admit, and, as the renewals progress, the gauge, surface, line and ballast section, should be corrected.

106. Roadmasters must personally inspect all ties removed from the track before they are disposed of to see that none have been removed which might have remained in the track with safety another year.

107. The excessive rail cutting of serviceable ties in the track is often the result of the adjoining new ties now furnishing their proportion of rail support, on account of being improperly tamped, which compels the older solid bedded ties to do double work, and results also in rough riding track. Sound rail cut ties shall be removed from main track if cut 1½ in. under the rail, when they should be turned and used in sidings. When renewing ties, the old tie-bed and adjacent ties should be dis-

turbed as little as possible. Preferably the mate
should be removed from about the old tie, the tr
jacked up sufficiently to permit its removal, w
out allowing material to run in under the adja
ties, and the new tie then slipped in and bed
after trimming up the old tie-bed for its recept
if necessary.

108. The tamping and ballast trimming for
ties renewed should be completed each day.

PILING NEW TIES.

109. New ties carried in stock, or those delive
along the track for use in the following sea
must be neatly piled for seasoning as near
point where they are to be used as possible, acc
ing to the standard method best suited to
quantity and local conditions.

(*a*) Piles of ties should be located at least
feet from the nearest main track rail, on the m
suitable piling ground, with a clear distance of
feet or more between piles, and so located as
to obstruct the view or cause snow to drift on
track, and when piled in yards they must not
less than 6 feet from the nearest siding rail.

(*b*) Whenever possible ground supports of so
stuff must be used, giving not less than 6 inc
clear space under the bottom of the piles, and
any case there must not be more than 2 ties
contact with the ground.

(*c*) All ties requiring peeling before use in
track, should, when time permits, be peeled bef
being piled.

(*d*) Squa
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(*d*) Square piles of ties should have one side parallel with the track. Triangular piles should have one angle pointed toward the track and the back of the pile parallel thereto, and where possible a uniform distance therefrom.

(*e*) The roof layers of square piles should be laid as close as possible; in all other layers there should be one inch of space between ties; to accomplish this, for large ties, seven only need be used per layer.

(*f*) Old ties which are removed from track must be piled at the end of each day not more than sixty to the pile, on opposite side of track from telegraph line, at least twelve feet from track, and burned when dry, after being so ordered, during the first suitable weather, unless some other disposition is arranged for by the Roadmaster.

SWITCH TIES.

110. Sawn ties must be used for all permanent switch turnouts, cross-overs and diamond crossings.

111. They should be of the best available wood, ends sawed square, and shall vary in length, as shown on the standard plans and specifications. They must be seven inches thick and nine inches in width.

112. They must be placed, spaced and lined in exact conformance with the standard plans.

TAMPING.

113. Satisfactory surface cannot be maintained with any kind of ballast except by properly tamping the material under the ties with shovels and tamping bars.

114. Tamping bars must be used on all ti
Ties must not be equally tamped through
their whole length. A sixteen-inch space on e
side of the rail must be thoroughly tamped, t
centre of the ties lightly tamped in order to preve
them from becoming centre-bound. Tamp joint a
shoulder ties particularly hard.

115. When ties are being renewed they must
tamped at once to give as solid a bearing as th
of the ties immediately adjoining to preserve t
surface of the rail.

116. When track is being re-ballasted, the balla
must be put under the ties and well tamped wi
shovel blade, and before ballast is trimmed it mu
be thoroughly tamped with tamping bars.

RAIL BRACES.

117. Rail braces shall be used on shimmed trac
guard rails, and switches, as shown on the standa
plans, and on curves where tie plates are n
provided.

118. Where rail-braces are used they must
placed in pairs one on each end of the same ti
on curves up to 4 degrees, use four pairs per
ft. rail length, increasing one pair per rail leng
for each additional degree of curvature until a
ties are equipped.

119. They should extend from the point on t
tangent where elevation of the outer rail begins,
the same point at the other end of the curve, b
their frequency along the easement curve or tange
should diminish in the same ratio as the elevati
of the outer rail decreases.

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TIE PLATES.

120. The standard forms of tie plates will be used to prevent spreading of track, overturning of rails and the cutting of ties by the rails. Tie plates must be placed in pairs, one plate under each rail on each end of the same tie.

121. The end with the widest margin must be placed on the outside of the rail.

122. When placing tie plates the tie should be carefully adzed the full length of the plate, the spike holes plugged, the rail lifted, the plate slipped and the track accurately spiked to gauge.

BOLTING AND JOINTS.

123. At the time that the rail is laid, the two centre bolts should be placed in each joint and tightened sufficiently to hold rail in line and preserve the expansion before the joint is spiked. The remaining bolts should then be placed and tightened as soon as possible. All joints must be fully bolted and rails drilled when necessary.

124. Nuts should be tightened a second or a third time as is found necessary and within thirty days after the track is laid.

125. One day of each month must be devoted by the Section force to the inspection of track bolts, and the Section Foreman must personally see that all joints are fully bolted, and that nuts are tight. The first working day of each month should be given to this work.

126. Inspect the rails before bolts are tightened, and take out kinks or bends with the rail bender.

127. When rails of different weights or sectio adjoin, they must be connected with compromi splice bars, made to fit the different rail sectio and bolt holes.

128. Spikes must be driven in the slots insi and outside of rail joint as follows:—On tange use two spikes per tie, on curves or creeping tra use 3 or 4 spikes as required (see Rule 135), exce on bridges or trestles where spiking in slots against the end of angle bars, or in any way ancho ing the rails to the bridge ties is prohibited.

129. Place the nuts of all track bolts on the ou side of the rails.

130. All laying of track must be done wi "broken joints" which must not vary more th 18 inches from the middle of the opposite rail.

131. Short rails may be used in inside line rails in curves of large central angle, in accordan with Rule 168, in order to maintain position joints near centre of outer rail. The difference length of outer and inner rails in feet for all curv is ascertained by dividing the central angle of t curve in degrees by twelve.

132. Insulated joints shall be installed only perfect rails of the section for which the joint designed. They must not be installed on the e of a rail which has been cut with a chisel or whi is not square and smooth.

133. Care must be exercised in installing i sulated joints to prevent damage to the fibres. T fibre bushings will not withstand severe blo on the bolt heads.

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SPIKING.

134. Track must be fully spiked, using the system commonly known as "Cross-spiking," with inside and outside spikes driven on opposite sides of the centre of the tie.

135. On tangents only two spikes per rail should be used in each tie; on curves use three or four as required. In general on curves less than 6 deg. three spikes should be used, and on sharper curves use four spikes. See also Rule 128.

136. Spikes must be set close against edge of rail and driven vertically to a full bearing on base of rail and they must be kept in this position. Driving sloping spikes, or giving them a final lateral blow to close the spikes against the rail, is forbidden. When driving spikes avoid striking the rail.

137. The inside and outside spikes should be set as far apart as the face and character of the tie will admit. Old holes must be plugged before spikes are redriven.

138. The track gauge must always be used when doing any track spiking.

139. Boat spikes 8 in. x ⅝ in. should be used for spiking frog and switch blocking to the ties.

140. Long track spikes for shimming work will be furnished on requisition, they will be 7, 8 and 9 inches in length. Spikes having a 90-degree twist must be used at all places where the rail is spiked direct to a stringer.

141. Spikes in service which are found to be neck worn or cut under the head enough to weaken them

and permit the possibility of shearing or breaki
off of the heads must be removed from the trac
See also Rule 20.

142. When snow is on the ground, Roadmaste
and Foremen must give the matter of spread tra
particular attention, noting the condition of sno
or ice around the rail, and if it shows any indicati
of having been disturbed by rail movement it mu
be cleared away and spiking thoroughly examine

CURVE EASEMENT.

143. Curve easements are transitions from ta
gent to curve, or from lighter curve to sharp
curve, by the introduction of a curve the degree
which increases uniformly, and should be used
possible on all main line curves of one degree a
over.

144. The object of easing curves at their e
tremities is to turn the trucks gradually, and th
avoid shock to car and rail, to secure a regular
increasing elevation of the outer rail, and a reg
larly increasing extra width of gauge, which sha
be consistent with the increasing degree
curvature. The length of easement curves will va
according to the amount of superelevation of th
outer rails. Lining this part of the track by ey
introduces a flat piece of curve and a correspon
ing sharp piece of curve, with which the changin
elevation of the outer rail seldom accords. In co
sequence, the introduction of these easements ca
only successfully be made by following the stak
set by the Engineer.

145. Th
curves and
location a
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ELEVAT

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Degree of Curve
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145. The Engineer will set centre stakes for all curves and easements (see Rule 172) and will give location and information concerning the elevation posts.

ELEVATION OF OUTER RAIL ON CURVES.

146. The elevation of outer rail on curves must be adapted to the speed of all classes of trains which pass over them, with due regard for comfort, safety and economy in track maintenance.

147. The elevation on single track must not exceed 6 inches. On maximum grades track on curves exceeding 6 degrees must in no case be elevated more than 4½ inches in order to avoid tendency of derailment of the slow trains.

On minor grades superelevation on curves exceeding 6 degrees must receive special consideration.

ELEVATION TABLE.

Degree of Curve	RATE OF SPEED IN MILES PER HOUR.								
	15	20	25	30	35	40	45	50	60
	In.	In.	In.	In.	In.	In.	In.	In.	In.
1	½	½	½	½	1	1	1½	1½	2
2	½	½	1	1	1½	2	2½	3	4
3	½	1	1	2	2½	3	4	4½	6
4	1	1	1½	2½	3	4	5	6	
5	1	1½	2	3	4	5	6		
6	1	1½	2½	3½	5	6			
7	1	2	3	4	5½				
8	1	2	3½	5	6				
9	1½	2½	4	5½					
10	1½	2½	4½	6					
12	2	3	5						
15	2½	4	6						

148. If after having elevated the outer rail according to table, the relative wear of rails indicates too much or too little elevation, the necessary adjustment in elevation, or speed of trains, shall be promptly made.

149. Uniformity of elevation is far more important than the exact amount of elevation.

150. The grade line must be maintained along the inner rail and the elevation obtained by raising the outer rail.

151. The full elevation of outer rail must not be continued beyond the end of the central curve, but should decrease uniformly, generally one-half inch per rail length along the easement curve to the tangent point, where both rails should be level. The Engineer will supply the stakes and notes for elevation of outer rail for all curves to whose ends easement curves have been applied.

152. When it is impossible to apply easement curves as above described the full elevation should be extended to the end of the curve from where it should run out gradually on the tangent to a level with the inner rail, by reducing the elevation of the outer rail one-half inch per rail length; except in cases where tangents are too short to permit.

In such cases distribute the run off between the respective curves to the best advantage and in proportion to the elevations given to the outer rail of the respective curves.

153. For compound curves full elevation should extend all the way round the sharper curve to the point of compound, and from there it should be run down gradually on the lesser curve, same as in the

case of tangents, until the elevation of the lesser degree of curve is reached, unless they be connected by an easement curve, when the elevation should decrease the same as for easement curves, according to the Engineer's instructions.

154. On all tangents the tops of the rails must be level with each other, except the approaches to curves which are not eased.

155. The track level must be used when surfacing either curves or tangents.

156. The track-jack must not be used between the rails, unless protected as per Rule 49.

157. To ascertain the proper elevation for the outer rail on curves whose degree is unknown or on curve easements for which the Engineer has not provided information, use the middle ordinate of the following chord lengths for the various speeds, which is approximately the proper elevation for the outer rail.

Speed	20	Miles	per	Hour,	Chord	Length, 32 ft.
"	25	"	"	"	"	40 ft.
"	30	"	"	"	"	48 ft.
"	35	"	"	"	"	56 ft.
"	40	"	"	"	"	64 ft.
"	45	"	"	"	"	72 ft.
"	60	"	"	"	"	80 ft.

GAUGING.

158. Perfect gauge is one of the principal features of good track, gauge kinks on tangents are as detrimental as low joints.

159. Gauge of track must be exact and uniform as prescribed. See also Rules 20 and 142.

160. The standard gauge is 4 ft. 8½ inches. Extra width of gauge on account of curvature must be given as follows:—

On curves of 3 and 4 degrees	⅛ inch
" " " 5 and 6 degrees.....	¼ "
" " " 7, 8 and 9 degrees.....	⅜ "
" " " 10, 11 and 12 degrees....	½ "
" " " 13, 14 and 15 degrees.....	⅝ "
" " " 16 to 20 degrees.....	¾ "

161. The extra width of gauge should be given by the inside rail, and be uniformly decreased on the easement curve, from point of central curve to point of tangent; *i.e.*, line the outside rail.

162. For curves not having ends eased as above the full extra width of gauge should extend to the end of the curve and the extra width be gradually decreased on tangent to tangent gauge on the low or inner rail in a distance of sixty feet.

163. Track gauges must be inspected once every six months by the Roadmaster and date of inspection recorded:—

1st. They must be exactly 4′ 8½″, between gauge lines.

2nd. The tee end must be square with the centre line of the gauge.

3rd. The heads or ends must be firmly fastened to the rod, and the rod must be straight.

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main track.

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RAIL.

164. The standard length of new rail is 33 ft. Short new rails have ends painted green, seconds i.e., defective new rails have ends painted white or yellow; seconds must not be laid in fast running main track.

165. Rail is the most expensive portion of the track, defects in which are usually permanent and apparent. They must be handled carefully before being put in the track, and must be uniformly supported after being placed there.

166. The rails may be distributed either from the ends or sides of car. If distributed from sides, both ends of rail must be dropped simultaneously. Skids will invariably be used whenever necessary to unload them into piles. In all cases the greatest care must be used to avoid injury to rails by dropping them on hard substances or uneven surfaces, or leaving them so unevenly supported on the ground as to cause any bending of rail.

167. When necessary to make holes in rails for bolts they must be drilled with the proper tools furnished for that purpose.

168. Short rails are advisable only as a temporary expedient on tangents and on inside rail of curves, they must not be used on the outside of curves and no piece shorter than ten feet should be used in main track.

169. When new steel is being laid all kinks must be taken out with the rail bender, and the track must be perfectly gauged. The spacing and renewal of ties and surfacing and lining of the track should follow as closely as possible.

170. The rails must be laid consecutively to li
and gauge, throwing out the rails from the old tra
ahead as the new rails are laid. Split points wi
be used for closing track for passage of trai
Accurate expansion cannot be secured if lo
stretches of rail are fastened upon one side of t
track and subsequently thrown into line.

171. In order to maintain the standard gauge,
least three lines of spikes must be drawn if old st
is being replaced by steel of wider section. "R
Cut" ties must be adzed to uniform bearing, a
old spike holes plugged.

172. Track centres will be furnished by the E
gineer every 200 ft. on tangents and every 50 ft.
less on curves. The track must be laid to confor
exactly to the line so established, and must
thrown to line and gauge ahead of the track laye

173. Roadmasters and Section Foremen mu
watch the flange wear of the outer rail on sha
curves, on account of the weakening of the rail a
the extra width of gauge which this wearing w
cause, and change worn rails to the inside of t
curve, or remove them from the main track entire
if they have been previously changed under t
following conditions:

First—When the joint bars are being cut or stru
by the wheel flanges.

Second—When the rail is weakened by the side
the head being worn as much as on
eighth of its original width.

Third—When the side of the rail head is worn
the slope of the wheel flange and fill
over which wheels are liable to climb.

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" 4	"
" 5	"

174. The position of the brand on the rail is material, whether right or left, inside or outside, but its position must be uniform in the same line of rails. When new rails are being laid different brands must not be mixed.

175. At least two serviceable full-length rails, suitable for main track repairs, must be kept on each railrack. Rails having pieces of head or base broken out or those having cracks, splits, pipes or other flaws must be removed from the main track as soon as discovered, as such rails are liable to break. The discovery and removal of such rails is most important feature of track inspection and maintenance. Track Walkers, Section Foremen and Roadmasters must be constantly vigilant in this respect.

CURVING OF RAIL.

176. All rails for curves of over 2 deg. must be separately curved, by a rail bender, before being placed in the track. The sledging or dropping of rails on ties to curve them is forbidden.

177. Particular care must be given to insure uniform curvature of the rails throughout their length, in accordance with the following table:—

MIDDLE ORDINATES FOR CURVING RAILS.

Length of Rails.	30 ft.	33 ft.
For 2 degree curve.....	½ in.	⅝ in.
" 3 " "	¾ "	⅞ "
" 4 " "	1 "	1⅛ "
" 5 " "	1¼ "	1⅜ "

Length of Rails.	30 ft.	33 ft.
For 6 degree curve.....	1½ "	1¾ "
" 7 " "	1⅝ "	2 "
" 8 " "	1⅞ "	2¼ "
" 9 " "	2⅛ "	2½ "
" 10 " "	2¼ "	2⅞ "
" 11 " "	2½ "	3⅛ "
" 12 " "	2¾ "	3⅜ "
" 13 " "	3 "	3¾ "
" 14 " "	3¼ "	4 "
" 15 " "	3½ "	4¼ "
" 16 " "	3¾ "	4⅝ "
" 17 " "	4 "	4⅞ "
" 18 " "	4¼ "	5⅛ "
" 19 " "	4½ "	5½ "
" 20 " "	4¾ "	5¾ "

NOTE: Ordinates at quarters equal three-quarter of middle ordinates.

178. To obtain the degree of a curve, when not given by the Engineer, stretch a 62 ft. cord on the inside of the outer rail at any curve. The middle ordinate, in inches, is the degree of curve.

EXPANSION.

179. Proper allowance must be made for expansion. The expansion space will be determined by ascertaining the average temperature of the rail at the time it is being laid, by means of a C. P. R. track thermometer. The thermometer must be placed on the head of the rail and be protected

EXPANSION.

Rule No. 179 for use on Western Lines only.

179. Proper allowance must be made for expansion. Expansion specified will be determined by the temperature of the atmosphere in the shade at the time the rail is being laid. The expansion for a 30′ or 33′ rail when the temperature is (as below) the expansion will be:—

90 Degrees Fahrenheit			0″	expansion	space
70 to 90	"	"	$\frac{1}{32}$″	"	"
50 " 70	"	"	$\frac{1}{16}$″	"	"
30 " 50	"	"	$\frac{3}{16}$″	"	"
10 " 30	"	"	$\frac{1}{4}$″	"	"
—10 " 10	"	"	$\frac{5}{16}$″	"	"

mum expansion space allowed between rails.

182. In order to prevent rails from creeping on steep grades and soft embankments, it is essential that each individual rail shall be anchored so as to insure freedom from contact with the rails adjoining. Creeping cannot be prevented if a number of consecutive rails are in contact. Special rail anchors will be provided for creeping track. They should be applied in accordance with special instructions and thereafter kept tight on the rail.

SWITCHES AND FROGS.

183. Switches must be put in track in accordance with the standard plans. The point of frog

of middle ordinates.

178. To obtain the degree of a curve, when no
given by the Engineer, stretch a 62 ft. cord o
the inside of the outer rail at any curve. Th
middle ordinate, in inches, is the degree of curv

EXPANSION.

179. Proper allowance must be made for expan
sion. The expansion space will be determined b
ascertaining the average temperature of the ra
at the time it is being laid, by means of a C. P. R
track thermometer. The thermometer must b
placed on the head of the rail and be protecte

rom the direct rays of the sun. When the average hermometer reading on 30 ft. or 33 ft. rails is:—

100	Deg. Fahr.	give	0″	Expansion	Space.	
75 to 100	"	"	"	$\frac{1}{16}$″	"	"
50 to 75	"	"	"	$\frac{1}{8}$″	"	"
25 to 50	"	"	"	$\frac{3}{16}$″	"	"
0 to 25	"	"	"	$\frac{1}{4}$″	"	"
20 to 0	"	"	"	$\frac{5}{16}$″	"	"

180. Rails must not be bumped together when ing laid.

181. Proper expansion must be secured by using ndard iron shims, according to the above table. pansion shims must be left in place until track full bolted and spiked for at least ten rail ngths ahead, and then be removed. Foremen in arge of rail laying must show on their daily ports the maximum and minimum temperatures nd during the day, and the maximum and minimum expansion space allowed between rails.

182. In order to prevent rails from creeping on ep grades and soft embankments, it is essential at each individual rail shall be anchored so as to sure freedom from contact with the rails adjoining. Creeping cannot be prevented if a number of nsecutive rails are in contact. Special rail anchors ll be provided for creeping track. They should applied in accordance with special instructions nd thereafter kept tight on the rail.

SWITCHES AND FROGS.

183. Switches must be put in track in accordance with the standard plans. The point of frog

must always be located where directed by t
Engineer.

184. Complete split switches will be suppli
only in 100 lb., 85 lb. and 65 lb. rail, except
special cases approved by the Engineer Mainte
ance of Way.

185. The main track through switches shou
wherever practicable, be tangent.

186. Split switches and spring frogs will
used for all main line turnouts, except that rig
frogs will be placed at the entrance to Termi
Yards, Junctions, etc. Special frogs and switch
will be used at Junctions where trains do not st

187. When temporary sidings are put in, t
main line rails must not be cut, but short closu
rails must be provided to fill the space betwe
the frog and adjoining rail.

188. At all stub switches bridle rods must
confined between two ties, placed six inches ap
to keep the rods in place, and to protect the
against derailed wheels.

189. Lead rails in all turnouts must be curv
separately by the rail bender before being la
The narrow spaces between rails at frogs, gua
rails and switches, in which the feet of switchm
are liable to be caught, must, unless iron blocki
is provided, be filled with standard wooden bloc
until there is a clearance of 5 in. between the r
heads. Section Foremen must see that these bloc
are kept in good order.

190. Where rail of a heavier pattern is used
the main track than in side track, the main li
pattern must extend, as shown on standard pla

so that co
different s
ties.
191. Th
to the swi
All switch
motion; the
them and
gauge, surf
men must
witches ar
are taken
cause, and a
are reopene
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are put into
representati
witches.
192. Wh
run through,
re-adjusted.
193. The
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oiled. Oil te
outer sleeve
cles of the
orm lubricat
veral times.
by putting a
and the head
when the poin
be easily thr
ions between

so that compromise angle bars, connecting rails of different sections, shall not be placed on switch ties.

191. The most careful attention must be given to the switches by the Foremen and Roadmaster. All switches must work easily and have no lost motion; they must not rattle when trains pass over them and must be kept lined up, and in perfect gauge, surface and adjustment at all times. Foremen must notify Roadmasters at once when new switches are ready for use or when old switches are taken out, when switches are spiked for any cause, and also when switches that have been spiked are reopened. Roadmasters must personally test all facing point main line new switches before they are put into service. The Section Foreman or his representative must daily inspect all main line switches.

192. When an automatic split switch has been run through, it must be considered defective until re-adjusted.

193. The clutch teeth and the moving parts of automatic split switch stands must be frequently oiled. Oil teeth by raising stand lever to disengage outer sleeve U. 984½, which exposes the four oil holes of the safety cap U. 985. To ensure a uniform lubrication after oiling, throw the switch several times. Test for lost motion or weak spring by putting a track spike between the point rail and the head of the stock rail at the point. If, when the point is thus blocked, the switch lever can be easily thrown and locked, examine all connections between the stand and connecting and No. 1

rods and readjust connections to take up lo
motion. If, with no lost motion in the conne
tions, the switch can be thrown and locked wi
points blocked, and the points remain open wh
the obstruction is removed, the spring is too we
and the stand must be returned to the shops f
repairs.

194. The use of salt at switches and frogs
seasons of uniformly low temperature is prohibite
it must only be used when snow melts during d
and freezes at night.

195. Approved derail provided with switch lo
must be placed at the clearance point of all sidin
where grade is such that standing cars by gravi
or force of the wind are liable to obstruct the ma
track.

196. The lead of a split switch is the distan
from the switch point to the frog point, measur
along the straight track.

Split Switch Leads on Tangent.

16 ft. 6 in. Points, will be approximately:—

No. of Frog.....	4	5	6	7	
Length of Lead..	45 ft.	52 ft.	57 ft.	64 ft.	70

No. of Frog.....	9	10	11	12
Length of Lead..	76 ft.	82 ft.	88 ft.	92 ft.

For switch leads on curves get data from t
Engineer.

197. T
distance
width or
inches.

198. T
overs me
be obtain

Frog Numbers
6
7
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9
10
11
12

199. Th
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conditions
Signals, St
Chief Engi

Double Tra
Main Track
Body tracks

197. To obtain the number of a frog divide the distance in inches from heel to true point by the width or spread of the heel over gauge line in inches.

198. The distance between frog-points in cross-overs measured along one of the parallel tracks can be obtained from the following table: —

Frog Numbers.	Distance between Centres of Track.									
	Ft. 12	In. 0	Ft. 12	In. 6	Ft. 13	In. 0	Ft. 13	In. 6	Ft. 14	In. 0
6	14	11	17	11	20	10	23	10	26	9
7	17	7	21	1	24	6	28	0	31	5
8	20	3	24	3	28	3	32	2	36	2
9	22	11	27	5	31	10	36	4	40	10
10	25	6	30	6	35	6	40	5	45	5
11	28	2	33	8	39	2	44	8	50	2
12	30	8	36	8	42	8	48	7	54	7

199. The standard distance between track centres as follows:

(These centres may be changed under special conditions such as Limited property, Location of Signals, Stand pipes, etc., where authorized by the Chief Engineer).

Double Track .....13′0″
Main Track and Passing Siding...14′0″
Body tracks of yards.....13′0″

Team Tracks .....36′0″ & 12′0″ alternately.
Car Repair Yards.....16′0″ & 24′0″
Main Line and adjoining Yard
Track through yards.....15′0″
Two parallel ladder tracks.....18′0″
Main Line or important running
track and parallel Yard Track 15′0″

SWITCH AND SIGNAL LAMPS.

200. The care and attendance of signal lamps will be as directed by the Superintendent.

(*a*) Switch lamps and their attendants are in charge of Roadmasters, unless otherwise directed.

(*b*) All lamps in service must be kept in first class condition. Defective or leaky lamps shall be sent to the Storekeeper for repairs, and defective workmanship or material in lamps shall be reported on defective material reports by the Bridge and Building Master or Roadmaster.

(*c*) All lamps must stand firm and plumb in their sockets.

(*d*) All lenses shall have corrugations on the inside. Lamps having chipped red lenses must be replaced at once.

(*e*) Semaphore spectacle glasses shall be inspected and cleaned, if necessary, each time lamps are removed for filling and cleaning. Broken spectacles or lenses which give the wrong color must be reported by wire to the despatcher unless they can be remedied at once.

201. In cleaning lamps remove all dirt from burners and lenses particularly that in the corrugations, remove all soot from top or bottom of lamp

clean all holes for ventilation or air supply, and remove all crust with the fingers from the top of the wick.

(*a*) Empty and clean with fresh oil, if necessary, all lamp fonts once a month in summer and twice a month in winter. Dirty oil must not be used in lamps.

(*b*) Standard kerosene oil, as supplied by the Company, shall be used for all switch and signal lamps. Signal oil is to be used in hand lanterns only.

202. Lamps must not be filled more than one-half inch below the top of the font. All wicks must be long enough to reach the bottom of the font, and they must fit burners snugly, but work freely.

(*a*) All lamps except long-time burners must be cleaned and filled daily. Wicks must be turned down below the top of the wick tube when not burning.

203. Long-time burner lamps require cleaning, filling and relighting twice a week. They will usually be attended on Saturdays and Wednesdays.

(*a*) Wicks in long-time burners must be changed once every 60 days or oftener if they become dirty, hard, or if a large amount of crust accumulates.

(*b*) Long-time burners may be used in all switch or signal lamps.

(*c*) New wicks in long-time burners are to be trimmed evenly with scissors or a sharp knife.

204. After lighting any switch or signal lamp and putting it in the body and closing the door, it should be looked at in five or ten minutes to see

that it does not smoke, at which time the flame should be about ¾ in. above the top of the burner, and at the same height as the centre of the lens.

GUARD RAILS.

205. Guard rails are used to prevent derailment at frogs, switches and on sharp curves, and to prevent derailed cars from wrecking bridges or from leaving the ties at derailing switches. "Hold up" rails to prevent blind driving wheels from dropping must be placed on all curves of 16 degrees or over.

206. Curve guard rails should usually be given 2½ inches space, with ends curved away from the track rail increasing the flangeway to six inches in six feet. They must be full spiked, and bolted through cast-iron filling blocks placed from 3 ft. to 6 ft. apart according to the degree of curve, and have rail braces on alternate ties. Other guard rails will be laid in conformance with the standard plans.

207. Frog guard rails will be supplied on requisition, they must be laid parallel to, with 1¾ inches flangeway from, the main track rail, except the ends which must be curved inwards, and be spiked, braced and bolted to the track rail through cast-iron filling blocks, as shown on the standard plans.

208. When it is necessary to put frogs on the outside of main line curves, which require extra width of gauge, it is necessary to increase the flangeway between the guard rail and the adjoining main track rail as much as the extra gauge, that is, if the gauge is 4 ft. 9 in., the flangeway should be increased to 2¼ inches. When frogs are placed

on the inside of main line curves, the gauge of the main track must be 4 ft. 8½ in., exactly through the lead.

TRACK POSTS AND SIGNS.

209. Standard station mile boards, rail rack posts, whistle posts, highway crossing signs, railway crossing junction and drawbridge posts, stop posts, slow posts, trespass signs, section posts, elevation posts, plow and flanger signs, bridge warnings, bridge and trestle number boards, culvert number signs, etc., must be placed and maintained in accordance with instructions on standard plans.

210. Section Foremen are required to see that all track signs and posts, above enumerated, are in their proper position in good condition and standing plumb. Should new ones be required, Section Foremen must make requisition for the same, and Roadmasters will instruct Foremen where and how to erect them.

211. All Track Posts and Signs should be painted every three years, and all Switch Stands and Targets must be painted at least once each year.

SHIMMING.

212. The necessity for the use of shims is an indication of poor drainage or poor ballast under the heaved ties, and should be remedied as soon as possible. In case the action of the frost makes it necessary to shim the track, it must be done in all cases on the tops of the ties. The placing of lum-

ber under the ties is forbidden, except in cases o emergency, and in all such cases it must be re moved as soon as possible.

(*a*) All shimming must be done to give the trac the proper surface, gauge, line and strength. Th shimming must be carried out far enough each sid of the high spots to insure easy grades, and whe one side of the track has heaved more than th other it must be brought to a proper surface, main taining the proper superelevation on curves an their approaches. Rail braces must be used as pe Rules 117, 118, and 119 when required to preve rails from canting, or tracks from spreading.

(*b*) The cast iron rail brace can be used on the 2 inch shims by placing the rails between the outsid holes so that the larger portion of the shim extend outside of the rail, giving a good seat for the ra brace. When rail braces are needed with the sho shims use old fish-plates, or any brace which may b adopted as standard.

213. Standard shims will be furnished upon re quisition; they should be made of the hardest loc lumber, and will be bored to suit the width of ba of rail under which they are to be used.

214. Standard shims vary in thickness from to 3 inches; they are 7 inches in width and inches in length for thicknesses ¼ to 1¼ inch inclusive. They are 7 inches in width and 24 inch in length for thicknesses 1½ to 2½ inches inclusiv Three-inch shims are 7 feet in length. 24-in shims have two extra holes for spiking the shi to the tie. Short shims may be used on top of 2 inch shims when necessary.

215. S throughou adzed to

216. T bridges, t cut down shimming

217. S upon requ more than

218. Sh soon as th when they preserved

219. Se devote a putting th houses, sta highway a combustible trestles, cu around buil platforms. and open c ected as n to passenge

220. On and grass edge of the oftener if d

215. Shims must be of the same thickness throughout and not wedge-shaped, and ties must be adzed to give them an even bearing.

216. Ties which are heaved by the frost at bridges, trestles, switches or elsewhere must not be cut down; good surface must be maintained by shimming the adjacent low ties.

217. Standard shimming spikes will be furnished upon requisition. They must be used with shims of more than one inch in thickness.

218. Shims must be removed from the track as soon as the frost leaves the ground in the spring, when they, together with the long spikes, must be preserved in the tool house for future use.

POLICING.

219. Section Foremen must with their gangs devote a few hours each week to cleaning and putting things in order around section and tool-houses, station grounds, yards, sidings and spurs, highway and farm crossings. They must remove combustible material from or around bridges, trestles, culverts, track posts, stock yards and from around buildings and under passenger and freight platforms. They must also see that drains, ditches, and open culverts at or near stations are so protected as not to be an inconvenience or annoyance to passengers.

220. On all Lines, their yards and sidings, weeds and grass shall be removed to a true line at the edge of the ballast section twice each season, or oftener if directed.

221. Cut all trees within the right-of-way that are in danger of falling across the track and those which obscure the view of enginemen or are liable to touch telegraph wires.

222. If adjoining land owners obstruct the ditches or culverts, Section Foremen should endeavour to prevent them from doing so, and in the event of failure, they must report the matter to the Roadmaster.

223. All scrap iron that may be found along the tracks should be gathered up and piled neatly in sight at the section tool-house, convenient for loading. The Roadmaster will arrange for its disposition.

224. Driveways on the Company's property must be kept clean and in good repair by the sectionmen.

225. The arrangement of tools and supplies in the tool-houses should be orderly: have a place for everything and keep everything in its place.

TRACK MATERIAL.

226. Section Foremen must make requisition on form prescribed for all necessary material, such as spikes, bolts, tools, and must send them to the Roadmaster with their time books.

227. All material, old and new, except scrap, must as far as possible be kept locked up in tool-houses.

228. Section Foremen will have care of and be responsible for all loose property of the Company on their sections, including wood, ties, lumber and

scrap iron; they will see that it is neatly piled, not closer than 8 feet from the rail.

229. All spikes that are being removed from the track must be carefully drawn, so that if serviceable they may be used again. Draw all spikes from old ties before they are thrown aside. All old spikes and bolts which cannot be used again must be gathered up and taken to scrap pile. In uncoupling rails tight nuts on bolts must not be knocked off with the hammer, but must be oiled and taken off with the wrench when practicable.

230. All scrap rails must be piled at side tracks ready for shipment. Serviceable rails not kept at mile posts shall be neatly piled where designated by the Roadmaster.

231. Whenever wood, cross-ties, lumber or other material is delivered along the main track for shipment, Section Foremen must see that it is piled at least eight feet from the rail. If found nearer, it must be removed at once to that distance.

EXPLOSIVES.

232. On sections where dynamite is kept for the removal of rock slides, Section Foremen must keep it stored at a safe distance from the Company's buildings, and where it is not liable to be interfered with.

233. Fuse and caps should be kept in the section tool-house, and stored in a box separate from other tools.

234. Dynamite must not be thawed out or us
by any but experienced men.

CLEARING RIGHT-OF-WAY.

235. All grass, weeds and brush on the right-
way must be cut at least once a year, and prefe
ably twice a year. This should be done in t
months which are most suitable, but must in a
case be done before the seeding time of the plant
After grubbing, cutting or mowing, the materi
should be raked into heaps and burned as directe
care being taken that the fire does not extend
fences, poles, posts or adjoining land.

236. When practicable old ties should be pil
around stumps for burning. Remove all stump
from the right-of-way, as time for such work
found, and gather up and burn old rotten logs a
other refuse which may have been left in the co
struction of the road, and bury any dead anima
that may be found upon the right-of-way, at lea
one-half mile from any city or village.

237. Where noxious weed and Fire by-laws exi
they must be strictly observed.

TOOLS.

238. Each section must have a full equipment
good standard tools sufficient to supply every m
in the gang, and several extra tools for the purpo
of replacing any that may be sent to the shop f
sharpening and repairs.

239. Th
ballast an
will be th
Foremen a
tion is ful
repair.

Tool Equi

Adzes ..
Axes.. .
Bars, Cl
" Cr
" Lin
" Ta
Boards, I
Brooms..
Cars, Ha
" Pus
Chisel, R
Cup, Tin.
Flags, Re
" Yel
" Gre
Grindston
Gauge, T
Globes, R
" W
" Y
" G
Hammers,
"

239. The kind of tools will vary according to the ballast and other conditions. The following list will be the minimum required on all sections, and Foremen and Roadmasters must see that each section is fully equipped, and that tools are in proper repair.

TOOL EQUIPMENT FOR SECTION GANG OF FOREMAN AND THREE MEN.

Adzes	2
Axes	1
Bars, Claw	2
" Crow	2
" Lining	2
" Tamping	4
Boards, Elevation	1
Brooms	1
Cars, Hand	1
" Push	1
Chisel, Rail	5
Cup, Tin	1
Flags, Red	2
" Yellow	2
" Green	2
Grindstone	1
Gauge, Track	1
Globes, Red	2
" White	1
" Yellow	1
" Green	2
Hammers, Maul	2
" Nail	1

Hammers, Sledge	1
Handles, Adze	1
" Axe	1
" Maul	2
" Pick	2
Jack, Track	1
Lanterns (complete)	4
Levels, Spirit, Pocket	1
" Track	1
Oil Can	1
Oiler	1
Oil (Signal) pints	4
Padlock and Key and Chain	2
Pail, Water	1
Picks and Handles	4
Platform, Dumping for Push Cars	1
Ratchet and 3 Drills	1
Saws, Hand	1
" Cross Cut	1
Scythe (complete) Grass or Brush	2
Shovels, Track	6
Switch Key	1
Tape, 50 ft	1
Template, Standard Roadbed	1
Torpedoes	12
Wrenches, Monkey	1
" Track	3

240. Rail benders, fence tools, track drills, e
pansion shims, track thermometers, wheelbarrow
and tools used by extra gang will be furnished
each Roadmaster, to be sent out as required a
returned to Roadmaster's headquarter's when wo
is completed. Tools in need of repair must b

shipped by
shops. Pl
whom it is
to cover re

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If tools
report must

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245. In c
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shipped by the Foreman to the Company's repair shops. Place a tag on each article, showing to whom it is to be returned, and send a requisition to cover repairs.

241. Section Foremen will be held strictly responsible for all tools and material left in their charge; they must guard against loss or theft and must not on their own responsibility lend or give any away.

If tools or material should be lost or stolen, report must be made promptly to the Roadmaster.

ACCIDENTS.

242. In case of an accident to a train the nearest Section Foreman must at once take his whole force, and go to the assistance of the train, even if it is not on his own section. If notified of broken rails or anything requiring immediate attention on an adjoining section, he must at once take such force as is necessary to protect the defective point and make the track safe for the passage of trains.

243. When assisting at an accident to a train, Section Foremen must act under the direction of the Conductor or Wrecking Foremen until the arrival of the Roadmaster.

244. In case of a wreck, Section Foremen must k drills, e when necessary appoint watchmen to prevent heelbarrow freight or Company's property from being stolen, furnished and such watchmen must remain on duty until the equired a goods are removed, or until they are relieved.

when wo 245. In case of personal injury to men in their ir must b angs, Foremen must immediately make a report

by wire to the Roadmaster on Form No. 295, a
follow this as soon as possible with a written re
on Form No. 74.

REPORTS.

246. Time-books must be written up each nig
for that day. The time of Foremen and men m
be given and same distributed to each kind
work performed, under the proper heading. Tim
books, as well as monthly reports of all tools a
material received during the month, must be s
to the Roadmaster at the end of each month.

247. When an employee is discharged the For
man must make out and forward to the Roa
master an application for a time-check, and endo
on the page of the time-book opposite the na
of the employee, "Certificate Given"; he will gi
the discharged employee an identification slip p
perly filled out.

248. Section Foremen must promptly report
the Roadmaster, in writing, any failure of engi
men to respect their signals, and to answer t
same with the whistle, giving the date and numb
of train and engine.

249. Section Foremen must report promptly
the Roadmaster, on Form No. 73, all stock kil
or injured on their sections.

250. An immediate report on Form No. 17
must be made by the Section Foreman to the Ro
master of all fences burned or other property a
material, located on or adjacent to the Compan

property, v
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251. Sec
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253. Sec
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MOTO

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257. Moto
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property, whether belonging to the Company or to private parties, destroyed by fire originating from passing locomotives or otherwise. The report must state the location, the exact damage done, and the name of the owner of the property.

251. Section Foremen must avoid all unnecessary use of the Company's telegraph, especially for material. The telegraph is only to be used in cases of emergency, or when delay would involve a loss to the Company.

252. Section Foremen must report on Form M.W.S. 15 all defective tools, supplies or materials received, giving nature of defect.

253. Section Foremen must report on Form M.W.S. 15½ all defective rails removed from main track.

MOTOR, HAND, AND PUSH CARS.

254. Hand-cars taken from the tool-house must always be equipped with the following signals:—2 red flags, 2 yellow flags, 2 green flags, and 6 torpedoes, and, at least, with the following tools: Spike maul, claw bar, gauge, track chisel, monkey wrench and track wrench. Foremen must always accompany their cars.

255. All push cars must be equipped with dumping platforms.

256. Motor, Hand, or Push Cars must not be left on or near public road crossings.

257. Motor, Hand, or Push Cars not in actual use must be lifted off the track and placed clear

of passing trains. When not within sight of trains. Copie
men they must be locked. 19" form.

258. Loaded Push Cars must not be run o (d) Small
main track, except under protection of prop t train ord
signals. (See Rule 49.) ines.

259. Motor, Hand, and Push Cars must not b 263. Foren
attached to a train; must be operated in prop e shops fo
direction in double track, and must be kept a suf spected the
cient distance apart to avoid accidents. ork, but no

260. Rails and frogs must not be carried on han the Roadm
cars, except in cases of emergency, and water keg r, will use t
track jacks and other tools likely to derail th ccident.
car if they were to fall off, must be carried o
the side or rear of same. TELEG

261. All cars must be kept in good order, wit 264. The m
bearings and machinery well greased, and shou e power wir
be thoroughly examined once a week for defects. other direc

262. (*a*) Motor, Hand, or Push Cars must n formation mu
be run at night or during foggy weather, exce 265. Section
in cases of actual necessity, when a red light mu e, and unite
be displayed, nor be used for personal purpose rt promptl
except by special permission. Hand cars must b nearest tele
run with great caution round blind curves, and b 266. Section
stopped frequently so that approaching trains ma rsons not em
be heard. wires of an

(*b*) All heavy gasolene motor cars, except se re, over th
tion motor cars, must be handled by train orde ey conside
from Train Despatcher, in the same manner as ft. above the
train. e Roadmas

(*c*) Small gasolene motor cars which weig 267. In cons
about 300 pounds and can be lifted on and off t telephone p
track promptly will be handled on train orders t centre of t
keep sharp look out and clear main track for a

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ins. Copies of order to be given all trains on 19" form.

(d) Small gasolene motor cars may be run without train orders on double track and on Branch ines.

263. Foremen must not ship their hand cars to e shops for repairs until the Roadmaster has spected them and decided that they need shop ork, but no Foreman, either before or after advising the Roadmaster of the bad condition of a hand r, will use the same, if to do so involves the risk ccident.

TELEGRAPH AND OTHER WIRES.

264. The measuring of clearance heights of electric power wires by means of a tape, cord, pole or other direct measuring device is forbidden; this formation must be obtained by the Engineer.

265. Section Foremen must watch the telegraph ne, and unite wires temporarily when broken; port promptly any derangement of the wires to e nearest telegraph office.

266. Section Foremen shall prevent unauthorized rsons not employees of the Company from stringwires of any description on highways and elsere, over the track or along the right-of-way. they consider any wire crossing to be less than ft. above the top of the rail they must report it the Roadmaster.

267. In construction and renewals all telegraph d telephone poles must be placed thirty feet from e centre of the track, unless the right-of-way is

too narrow for this distance, in which case poles must be placed as far from the track as right-of-way will permit.

Section Foremen must report any variation this rule.

ROAD CROSSINGS.

268. Road and street crossings must be constructed according to standard plans.

269. The planking at Public Highway crossings must be maintained in good order during the whole year.

270. On such portions of the main line branches as the running of snow plows or flangers require it, the planks may be removed at farm crossing during the winter months, and these planks must be replaced in the spring as soon as the snow is off the ground.

271. Crossing planks must be securely fastened to the ties to avoid interference with trains.

272. Road crossings should, when practicable, be underdrained by tile or stone drains, laid three feet deep, parallel to the track at the edge of the ballast.

273. Section Foremen must provide proper surface drainage at road crossings, remove all mud, snow and ice and keep the flange-ways clear.

TRESPASSING ON RIGHT-OF-WAY.

274. Foremen must make themselves familiar with all the boundary lines of the Company's pro

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erty on their respective sections, and see that no one encroaches upon them, as the erection of fences and buildings, and the construction of roads, etc., upon the Company's property by outside parties is prohibited except upon proper authority. If any attempt at encroachment is made, same must be reported in a written statement to the Roadmaster, giving the name and address of the party and all facts connected with the matter.

275. Trespass on the Company's property by pedestrians, live stock, teams, etc., should be prevented by the section Foreman. Erect standard trespass notices where necessary. Should Foremen be unable to prevent such trespass they must report same to the Roadmaster.

276. Section Foremen must prevent any person from attaching advertising cards or posters to, or painting signs of any kind upon fences, telegraph poles or structures belonging to the Company, unless provided with proper authority. Any unauthorized signs, posters, cards or similar disfigurements must be detached or obliterated from the fence or buildings as soon as discovered.

277. Section Foremen must prevent any person or persons, unless provided with proper authority, from stringing wires or constructing road-crossings across the tracks or from laying drain, sewer or water pipes under the track, whether in roads, streets, or otherwise.

WORK TRAINS.

278. Roadmasters having charge of snow-plow, gravel or other work trains on their divisions must

see that all such trains are equipped with proper apparatus for economic work. They must inspect boarding and sleeping arrangements for the men, and see that sufficient wholesome food and comfortable quarters are provided.

279. Cars not needed for handling material must not be taken in work trains, except for shelter of men in stormy weather, without authority from the Superintendent.

280. Insufficient and defective equipment in work trains must at once be reported to the Superintendent.

281. Work trains, or engines belonging thereto, must not be run except as may be absolutely necessary for the prosecution of the work assigned them.

WATER SUPPLY.

282. Section Foremen must give attention to water stations where pumpmen are not employed, keep tank filled and report to the Roadmaster any defect that they cannot readily repair.

283. They will attend to the heating of such water stations when required.

284. Section Foremen must see that the fire protection water barrels, at bridges, trestles and buildings are kept filled during the summer season and that they are emptied when freezing weather begins. They are responsible for the proper care of barrels and pails.

SNOW AND ICE.

285. Section Foremen must attend to the removal of snow and ice from station platforms and side-

walks, water stations, road-crossings, track scales, switches, frogs and railway crossings, and turn-table pits when necessary.

286. They must, when necessary, see that all portable snow fences are taken down in the spring, and are put up in their proper places before winter begins.

287. They must keep all snow-fences in repair, and report all new large drifts at unprotected points; remove all ice from rails and flange-ways, as well as that in tunnels, snow sheds or rock cuts, which may interfere with the safe passage of trains.

288. Surface ditches and ends of all culverts must be cleared of snow where it is liable to interfere with the free passage of water during the spring thaw.

FENCES AND CATTLE GUARDS.

289. Section Foremen are responsible for the proper maintenance of the right-of-way fences, gates and cattle-guards on their sections. Extensive renewals will usually be made by a fence gang. All wing fences and cattle guards must be whitewashed.

290. Right-of-way fences will be of three different types; woven, field-erected, and stock-range.

(*a*) Woven wire fence in two standard sizes will usually be used. The first contains five and the second seven smooth horizontal wires. They are manufactured ready for erection.

(*b*) Field erected wire fence in the two standard sizes will be used only when the roughness of the

ground renders impracticable the proper stretching or economical erection of the woven wire fence. The first contains five and the second seven smooth coiled horizontal wires, supplied in coils of single wire, bundles of stays and boxes of locks. It is assembled in the field.

(*c*) Stock-range fence will be used only in wild cattle grazing districts. It is composed of four horizontal barbed wire with wood stays (droppers), and is assembled in the field.

(*d*) The five smooth wire 44″ fence will be used in farming districts where large stock only is to be turned.

(*e*) The seven smooth wire 48″ fence will be used at all other places.

(*f*) All posts must have the bark removed, be set plumb with the large end down at the depths and distances apart specified by the standard plan and specification.

(*g*) Holes of full depth must be provided for all end and gate posts, even if blasting has to be resorted to. For intermediate posts not more than two adjacent posts may be set on sills equal to 6″ x 6″ x 4 feet long braced on both sides by 2″ x 6″ braces 3 feet long, where rock is encountered, holes must be provided for all other posts.

(*h*) In localities where posts are heaved by frost the lower end of the post must be pointed, to enable the section men to drive them down in the spring.

(*i*) All posts must be in perfect line and after fences are erected their tops shall be sawed off, with a one quarter pitch level, the high side being next to the wire.

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(*j*) All end and gate posts must be anchored as shown on standard plan. Intermediate posts set in depressions of the ground shall be anchored by two cleats gained into the bottom of the posts, same to be properly spiked.

(*k*) All end, gate and corner posts must be braced as shown on standard plan; in long lines of fence intermediate bracing panels must be set every quarter mile.

(*l*) On tangents, wires must be placed on the inter side of the posts from the track. On curves, he fencing shall be placed on the outer side of the osts from the curve centre.

(*m*) Horizontal wires must be stretched uniformly tight and be parallel. Stays shall be straight nd vertical and be uniformly spaced.

(*n*) All spacing of both horizontal and vertical ires must be according to standard plan.

(*o*) All staples must be set diagonally with the rain of the wood. In end posts they must be riven home tight; in intermediate posts they must e driven as tight as possible without preventing he free expansion or contraction of the horizontal ires.

(*p*) The top wire must be double stapled hroughout except in the stays of stock-range fence.

(*q*) All splices must be made according to the ethod shown on standard plan.

(*r*) The top wire shall be 4'6" above the ground or all kinds of fence.

291. Gates should always open away from the rack and with their fastenings must be properly nd effectively maintained.

292. Standard surface cattle-guards will be us where necessary.

TRACK SECTIONS.

293. Track sections shall be numbered, beginni with number one at zero mileage of each Subdiv sion and running consecutively in the direction the mileage.

294. Section tool-houses shall be located so th the track in front of them will not be occupied b standing trains or cars.

295. Section dwelling houses will usually be l cated so that they shall be one section length apar and, where possible, should be located at or nea telegraph stations.

SPECIFICATIONS FOR TRACK TIES AND FENCE POSTS.

296. Ties may be of Oak, Rock Elm, Ceda Tamarack, Hemlock, Jack Pine or Douglas Fi They must be of live, straight timber, free fro rot, bad knots, wind shakes, or other imperfection

(*a*) If made from the round tree they must b sound, sawn or hewed smooth and free from scor hacks, to uniform and parallel faces on two opposit sides. Cedar or all thick bark timber must b peeled when so stipulated in the contract.

(*b*) If sawn square from large timber they mus be cut through the centre of the log. Ties saw on three sides will be accepted, of the same dimen sions as squared ties.

(*c*) Ties must be of the following minimum dimensions in cross-section:—

No. 1 Flatted Ties, seven inches thick with seven to twelve inches face.

No. 1 Squared Ties, seven inches thick with nine inches face.

No. 2 Flatted Ties, six inches thick with six to twelve inches face.

No. 2 Squared Ties, six inches thick with eight inches face.

All ties should be exactly eight feet in length, with ends sawn square, and face measurements shall be inside the bark at the smallest end.

(*d*) Ties of smaller cross-section or over twelve-inch face, and those having defects in manufacture or quality of material which would not render them unfit for use in side tracks may be accepted as culls when required. All others must be rejected. Mill ties must be exact as to length, but in hewed ties a variation of one inch under or one inch over will be allowable for No. 1 and No. 2 ties. Shorter lengths must be rejected and longer lengths culled. If ties are very uneven in thickness or are crooked sideways three inches or over, or are hewed with a wind of one inch or more in the face, they must be culled. Cedar ties may be accepted as No. 1 and No. 2, if they have not more than one inch in diameter of ground rot at one end only, and it does not appear to extend more than twelve inches into the tie, and the tie has at least eight or nine inches face, otherwise they must be culled.

FENCE AND STOCK YARD POSTS.

297. Posts shall be made from sound, straight, round cedar, or green tamarack, sawn square at both ends. When split cedar posts are contracted for, great care must be taken in the inspection to accept only those which are split true and straight, and carry the proper size their entire length. Cedar posts must be peeled, unless contract provides otherwise.

(*a*) Round fence posts must not be less than five inches in diameter at small end. Split cedar fence posts must not be less than six inches on any face or in cross-section at small end. Round fence posts from five inches to four inches diameter at small end may be accepted as culls up to ten per cent. of the whole. Smaller fence posts must be rejected. Length of standard fence posts to be eight feet.

(*b*) Stock Yard posts must be of round cedar, of following dimensions:—10 feet long, not less than eight inches diameter at small end; 12, 14 and 16 feet long, not less than nine inches diameter at small end.

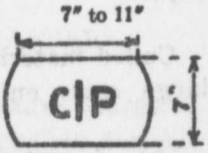
(*c*) Snow Fence posts must be of round cedar, of following dimensions:—10 and 12 feet long, not less than six inches diameter at small end; 5 per cent. may be accepted as culls, if not less than five and under six inches at top end. Smaller sizes may be accepted as fence posts if, when cut to eight feet in length, they will not be less than five inches diameter at top.

(*d*) Gate posts, 12 feet long, and not less than nine inches diameter at small end; 9 feet long, and

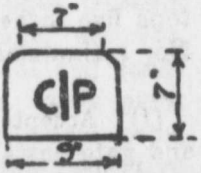
not less than seven inches in diameter at small end.

298. All material inspected and accepted for the Company must be plainly stamped in the manner following:—

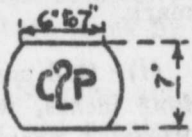
(*a*) A No. 1 tie.



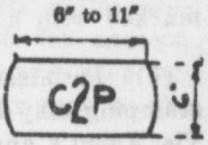
(*b*) A No. 1 square sawn tie; may have one inch of wane on one or both corners of one side only.



(*c*) Intended for a No. 1 tie, but culled for being under size in section only. When sound and well made this tie shall be entered in Inspection Book as No. 2, but may be loaded with good No. 1 ties.

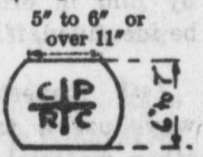


(*d*) A No. 2 tie.



(*e*) A No. 2 square sawn tie; may have one inch of wane on one or both corners of one side only.

(*f*) A cull tie; stamp thus if sound timber and well made. Smaller ties, or those having visible rot, or badly made ties, must be rejected, and will not be marked in any way.



(*g*) Accepted material will be stamped with No. 1 Hammer mark, and with red keel or paint mark the length of each pile in figures about three inches high.

Culled material. With red keel or paint make a large cross only. No hammer marks.

(*h*) Accepted posts of standard 8 ft. lengths, tops five inches and over, will be stamped with the No. 1 Hammer mark.

(*i*) Accepted posts for snow fences, stock yards and gate posts will be stamped with No. 1 Hammer mark.

(*j*) Cull posts, tops under five and not less than four inches, will be stamped with cull hammer. Rejected posts, tops under four inches, will be marked with a red keel or paint cross only.

(*k*) Permission to accept material without stamping may be given by inspectors, with General Tie Agent's approval, in special cases.

(*l*) The maker or sub-contractor's name should be marked on the face of a tie or side of a post, etc., at each end of the pile of material delivered by him in order that each man's deliveries may be identified, if required, in the event of any dispute.

(*m*) Inspectors and their assistants should always use a tally register when counting ties or other material.

BRIDGE AND BUILDING.

Rules and Instructions.

BRIDGE AND BUILDING MASTERS.

299. Bridge and Building Masters have charge of renewals and repairs and are responsible for the proper inspection and safety of all bridges, trestles, tunnels, snow-sheds, culverts, buildings, wharves, track scales, platforms, water supply, coal and sand-handling plants, ash pits, turn-tables, cattle pens, signals, interlocking plants, crossing alarm bells, crossing gates, and all buildings on their respective divisions, unless relieved of some of these items by proper authority.

300. They have charge of all labourers and mechanics engaged in these renewals and repairs, and must see that they perform their duties properly, and they may discharge them for neglect, incompetence or misconduct. They must keep account of and report the time of their men in the manner prescribed.

301. They must know that the persons under their charge are supplied with, understand, and obey all the rules and regulations concerning their duties, and that they understand the use and meaning of signals.

302. They must give necessary assistance in case of accident in any department.

303. They must use standard watches, have correct time, and compare watches with their foremen as often as possible.

304. They must supervise any work being done on or about structures by contractors or others, which will affect the safety or regularity of trains, and see that the track over same is safe for the passage of trains, and that proper signals are displayed.

305. They must make careful and prompt enquiry and report fully, on the prescribed forms, all accidents that may occur to employees or structures under their charge.

306. They must see that each of their gangs is supplied with the necessary tools and appliances to economically and properly perform the work assigned to it, and report all defective tools and material on the proper form.

307. They must see that materials are safely kept and economically used.

308. They must be familiar with the instructions issued for the governing of trains and trainmen, and report to the Superintendent any neglect of duty or violation of rules that come under their notice.

309. They must see that all renewals and extensive repairs are made in accordance with standard plans, or plans specially prepared for same.

310. They must take personal charge of the more important repairs to structures when damaged by wrecks, storms, fire or slides.

BRIDGE NUMBERING.

311. Bridges, trestles and culverts will be numbered with respect to the mileage, i.e., the bridges beyond each mile board in the direction of the mile-

age will be the mile board number followed by a short dash with the decimal of the mile in which the structure is located, thus "25-3," "25-4," prefixing the word "bridge" or "culverts," as the case may be, in records and reports. Where two or more such structures are located on the same tenth of a mile, the nearest hundredth will be used thus "25-44," "25-48."

These numbers must be erected according to the standard plans.

BRIDGE INSPECTION.

312. The Division Engineers will make occasional examinations of the condition of all important bridges and culverts. In an emergency they will, on their own authority, give such instructions to Bridge and Building Masters as they consider necessary for safety of traffic, and advise General Superintendent.

313. Great care must be taken by Division Engineers, Resident Engineers and Bridge and Building Masters, to whom the security of structures is intrusted, to make their inspections so thorough and the records thereof so complete as to convey definite and precise knowledge of the condition of each and every structure at the time of the last inspection.

314. There shall be two regular inspections each year, as follows:—

1st. In the Spring by the Resident Engineer and Bridge and Building Master for each division, of all truss and large trestle bridges.

2nd. In the Fall by the Division Engineer, Superintendent, Resident Engineer and Bridge and Building Master, of all bridges, culverts, trestles, retaining walls, etc.

315. In addition, the Resident Engineer and Bridge and Building Master shall at all times make such further inspections as may be necessary to keep thoroughly posted as to the conditions and safety of all bridges, trestles and culverts on their divisions.

316. The Bridge and Building Master will forward his report (Form 921) of these inspections to the Superintendent, and a copy of the same to the Resident Engineer, who will send it to the Division Engineer.

317. The Resident Engineer will arrange to obtain the record of extreme high water at the time of each flood, or extraordinary freshet, at all bridges, culverts and openings, and will forward this data to the Division Engineer, who will retain a copy and forward it to the office of the Chief Engineer for record.

318. The Bridge and Building Master will furnish monthly reports (Form 923) of all repairs and renewals of bridges, culverts, etc., executed during the month, to the Superintendent, and a copy of the same to the Resident Engineer, who will send it to the Division Engineer. The Division Engineer will check the same against the inspection requirements as contained in Form 921 for the purpose of insuring compliance with such requirements. At the completion of the work the Bridge and Building Master will advise the Resident Engineer, who will

measure up the structures, revise his Bridge Record Books accordingly, and forward prints of the corrected sheets to the Engineer of Bridges and Division Engineer for record.

319. The Fall inspection must be made with special reference to obtaining data for estimating the cost of renewals and repairs and for the material required for the ensuing year.

320. Following the Fall inspection, estimates of the cost of repairs, renewals and replacements recommended for the ensuing year will be prepared on form 926 by the Resident Engineer with the assistance of the Bridge and Building Master, passed on to the Division Engineer, who, after checking will forward to the General Superintendent for approval and be sent by him to the Chief Engineer.

321. The character and extent of renewals and improvements will be determined from this report. Descriptions and estimates will be given for permanent structures, wherever same appear desirable or economical.

322. Note books of inspection (Form 920) must be filled out at the structure after careful examination has been made of each of the points itemized in the blanks, using, in cases where there are a number of spans in which defects are observed, a properly noted column for each span. When the spans are all in good condition, one column only need be used, but the number of spans should be noted.

Designate the separate spans of a bridge by numbering them in the direction of the bridge numbers on the division, and the separate bents or piers in same manner, commencing with abutment

bankbent or sill as number one. Designate the truss as the right or left, locating points on it by numbering the panels in the same direction as the spans are numbered.

323. When any members of wooden structures, on account of their age, appearance or position, are liable to be decayed, they shall be tested by boring, and the holes are to be plugged as soon as the inspection is completed.

324. When making the regular inspections, the Inspectors will take a statement of the results of the last examination relative to such structures as required attention at that time, and in reporting on these structures, special notes shall be made as to whether the repairs and recommendations of the previous examinations have been fully carried out or not, and whether the work is in accordance with the standard plans.

INSTRUCTIONS REGARDING INSPECTION REPORTS.

325. 1. Note if the waterway requires straightening, cleaning out or enlarging above or below structure. Does structure afford ample waterway? Is riprap needed to maintain channel or protect roadway?

2. Note line and surface, also condition of rails, joints and fastenings on bridges and approaches. See that rails are braced or tie plates used on curves when necessary, and that track on approaches is firmly bedded, avoiding shock or jolt to train as it passes on to bridge.

3. Note any rotten, split, or otherwise defective bridge ties, giving number, size and kind.

4. See if guard rails are in line and bolted or spiked down tight.

5. Note condition of caps and stringers, particularly at points where they bear against other members.

6. Note if plumb and batter posts are crooked, split or decayed, and if bents stand plumb.

7. See if trestle towers or bents are properly sway-braced, and all braces longitudinal and transverse are drawn up tight and have sufficient bolts or spikes to hold them properly.

8. Note particularly the condition of piles where they enter the ground or water. See that they stand properly.

9. Examine each pier and abutment as to joints, settlement, imperfect stones, cracks or other defects; note if work needs pointing up or if cracks have opened since last pointed; make such measurements as will locate position of cracks, and note on sketch on back of report blanks:—Condition of riprap, if any. Is riprap needed to prevent undermining? How much? Condition of pedestal stones, and whether bridge seat is clean and water drained off.

10. Note condition of culvert and retaining walls. See if they are yielding by settlement or bulging from the pressure of the embankment. See if proper drainage is provided for.

11. Note condition of ring or covering stone, of box or arch culverts.

12. Note condition of paving and riprap, and that same is so placed that it cannot be undermined by washing.

13. Does pipe drain need head or tail wall to protect embankment from washing? And does it clean itself of water?

14. Does timber box need to be replaced with masonry or culvert pipe? If so, give dimensions required to give ample water-way, and give height from bottom of stream to rail.

15. See if bed plates and rollers are clean, and if the latter stand so as to move squarely back and forth with the truss. See if pedestal takes an even bearing on rollers. Examine anchor bolts.

16. Observe particularly the condition of wall plates where bolster rests upon them. Note any appearance of crushing or decay.

17. Note condition of bolsters and corbels. See if holes are bored through them where they cover the spaces between chord sticks, to prevent the collection of water, and there is any indication of decay where they are in contact with chord.

18. Angle blocks and all cast iron members, such as chord boxes, post shoes, etc., must be examined for cracks and for any indication of displacement by reason of daps splitting or timber crushing. A hole of one-fourth inch in diameter, if drilled at the end of a crack, will frequently stop its extending farther.

19. Note particularly any appearance of opening of bottom chord joints. Wooden bridges over four years old should have gauge blocks at all joints in the middle half of the span, made by fastening two planed and squared blocks, two inches by one inch, six inches long, to the chord sticks with screws, and scribing a fine line across both. Any movement of

joints should be noted, giving location and amount, scribing a new line from the old one on the outside block across the inside block. See if clamp daps are shearing.

20. See that all chord and packing bolts are tight. Nuts on all bolts through guard rails, ties, stringers, and floor beams must be secured in place by burring the thread of the bolt at two or three places with a centre punch or chisel.

21. Note any signs of decay or crushing in packing blocks and see that clamps and keys are in proper condition.

22. See if gib plates are distorted, or crushing into the chords; if they are, give their location and dimensions; number, size, and spacing of rods passing through them. Give size of rods over threads.

23. Note condition of sides and roof of covered bridges, or of chord and end post covering.

24. Notice particularly the connection between stringers and floor beams, see that connecting angles are not split, neither in the angle nor through in the line of the rivet holes. For wooden stringers, note condition as to soundness and bearing.

25. Notice particularly the connections between floor beams and trusses for evidence of imperfect bearing, or splitting of connecting angles. If suspended, notice if they are up tight against the post feet, or free to move.

26. Test equality of tension in tie bars by springing them. Look for any signs of distortion or crookedness in bars of end panels of bottom chords. Howe truss rods, counter lateral and vibration rods must never be allowed to hang loose. They must

not be adjusted while a load is on the bridge. They should be tightened enough to give close and even bearings, but must not be overstrained, as unnecessary strains are put on compression members if too much power is used in adjusting tension members. See that the centre line of all tension members is the same as the line of strain.

27. Examine all tension members carefully, especially at the joints.

28. See if posts, lateral struts and top chords are straight and free from twists. On wooden bridges, see if braces are up in place, taking a square bearing at ends, and note if any warping is evident. Note their condition as to soundness.

29. Examine all lateral connections, and see that lateral tension members are straight. Examine bracing in iron trestles.

30. Make particular examination of all hangers, testing each nut to see that it is tight. A streak of white paint drawn across nut and bearing will indicate any movement. These nuts should be screwed up tight and secured by burring the thread of the bolt and nut at two or three points with a centre punch or chisel.

31. Note any pins which indicate the movement of any of the members coupling on them, or that have loose nuts. All pins and nuts should have a streak of white paint across nut and pin end.

32. All field driven rivets in floor beams and stringer connections should be lightly sounded to see that they are tight. Also lateral connection rivets in riveted trusses, and any intersection or other rivets which indicate by rust streaks or otherwise, that there is movement at that point.

33. Note if there are any members, such as closed columns, pedestals, etc., which catch and retain water by reason of not having proper drain holes.

34. Note carefully the line of each truss by the top chord and by points on the floor beams equidistant from the centre of the posts. Also note the camber in the top and bottom chords, whether it is true and uniform or irregular.

35. Look for loose rods, hangers, loose braces, unequal sized timbers and other defects which require adjusting in order that each of the different parts may have proper bearings and carry its proper part of the load.

36. Note any undue vibration of the structure under live load.

37. Note excessive deflection of the structure under live load, seeing if the two trusses have the same deflection.

38. See if any rust spots are apparent under the paint. Note if structure needs repainting. Iron bridge work should be scraped and repainted, as often as necessary to preserve from rusting.

39. See that proper guard rails are on all bridges, as required by the Standard Plans.

40. See that all ties are properly spaced and separated to guard against bunching in case of derailment.

41. See that there are no long spaces at ends of bridge between land ties and bridge ties.

42. See that all rail lifts or rail bolts are properly working and all fastenings tight.

43. See that all gasolene for operating swing or

other movable bridges is properly stored and protected against fire.

44. See that all power cables are properly secured and protected and well insulated against short circuiting and electrolysis.

45. Note such wooden structures as require barrels to add to their safety against fire, giving number required. State condition of such barrels as may be in position. Of all bridges of such magnitude as to require a watchman, there should be a foot plank between the rails securely fastened to the ties to facilitate crossing the bridge quickly in emergencies, such as fire or danger to trains. Note if ladders, either fixed or portable, are required for the safety of the structure or to facilitate inspection.

46. See if material, driftwood, weeds, grass or other rubbish is properly removed and burned, or otherwise disposed of.

FIRE PROTECTION AT BRIDGES.

326. Roadmasters, Bridge and Building Masters, Section Foremen, Bridge Watchmen and Track Walkers must familiarize themselves, and comply with, the provisions of Order No. 11446 of the Board of Railway Commissioners of Canada, dated 26th August, 1910, reading as follows:—

IT IS ORDERED AND DIRECTED:

1. That every railway company subject to the legislative authority of the Parliament of Canada, operating by steam power any railway or railways,

any part or parts of which is or are constructed of, or upon, wooden trestles the whole of which cannot be seen from an approaching train for a distance of at least one thousand feet, do, during the months of May, June, July, August, September, and October of each year, provide, place, and keep a watchman, track-walker, fire alarm signals, ballast flooring, zinc covering over caps and intersections, or approved fireproof paint, as hereinafter directed, for the purpose of protecting the said trestles from fire; each such company having the option of adopting any of the said foregoing methods of protection.

2. That every such company shall cause to be placed and maintained at every trestle less than thirty feet in length, one barrel of a capacity of at least forty-five gallons, and on trestles of over thirty feet in length a like barrel upon or near each end, with intermediate barrels of the like capacity not more than one hundred and fifty feet apart: Provided, however, that pile trestles over streams or other bodies of water need not be furnished with intermediate barrels.

3. That every such company shall cause the said barrels to be kept filled with water.

4. That every such company shall cause all brush and dead grass to be removed from beneath and around every such trestle, and shall cause its right-of-way crossed by such trestle to be kept free from combustible matter.

5. That, on or in the neighborhood of timber lands, or in localities distant from settlement, every such company shall cause to be provided pails for use at all trestles, and all watchmen and track-

walkers shall carry such pails while upon duty at trestles.

6. That where the protection provided is by watchman or track-walker, all trestles on main lines shall be inspected at least twice each twenty-four hours, at intervals of not less than eight hours, and once every twenty-four hours on branch lines.

7. That in the event of any such barrel or pail not being in good and efficient condition for holding water, every such watchman or track-walker shall forthwith repair or replace the same, or if it cannot be done by him, he shall forthwith report such condition to his superior officer. Every such watchman or track-walker shall see that water barrels are at all times kept filled to within ten inches of the top, or forthwith report same to his superior officer. Every such watchman or track-walker, whenever any such trestle is injured by fire, shall, as soon as possible thereafter, report the same to his superior officer.

8. That the fire alarm signals be equal, in the opinion of an Engineer of the Board, to the Montauk Thermostat.

9. That if fireproof paint is used, one coat thereof, at least equal to the Clapp Fireproof Paint, be applied at least every five years.

10. That the ballast flooring be of gravel and be at least equal to the standard of the flooring adopted by the Great Northern Railway Company, plans of which are on file with the Board under file No. 4966, case 1860. This flooring consists in a complete coating of gravel from beneath the

head of the rail to the ties, and extends laterally from outside guardrail to outside guardrail.

11. That if zinc or galvanized iron is used, the caps, stringers, and the outside of the batter posts of every such trestle, and, if the company desires, the ties, be covered with a zinc galvanized iron covering.

12. That every such railway company failing or neglecting to comply with any of the foregoing regulations, shall be subject to a penalty of thirty dollars.

13. That every such watchman or track-walker failing or neglecting to make inspection in accordance with the foregoing regulations, or failing or neglecting to make any of the reports herein required of him, or otherwise defaulting in any of the duties imposed upon him by this Order, shall be subje ' to a penalty of fifteen dollars for each such failure or neglect.

14. That every such railway company shall cause every such watchman or track-walker to be furnished with a copy of this Order.

15. That the Order of the Board No. 5103, dated July 30th, 1908, be, and it is hereby, rescinded.

327. Water barrels of at least forty-five gallons capacity shall be placed at all wooden bridges, and all steel bridges with wood decks. At bridges with a length of less than 30 ft. one barrel shall be provided; for longer bridges a barrel shall be placed at each end, and also on the deck of wooden bridges at intervals of 150 feet, and on steel bridges at intervals of 200 feet.

Barrels shall also be placed in the ground at the bottom of wooden trestles 20 ft. high or over, where there is no stream or other body of water adjacent, spaced at intervals of 150 ft.

328. Barrels placed at ends of bridges shall be set in the ground to within 6 inches of the top, about 12 ft. from end of structure, and those placed on bridge decks shall be secured to platforms outside of outer guard rail. Inside of each barrel shall be placed a four-gallon bucket, the bottom of which shall have two small holes punched in it, to prevent its use for other purposes. All barrels shall be provided with a cover.

329. Barrels placed on bridge decks shall be painted on the outside with C. P. R. Bridge paint. The Bridge and Building Master shall be responsible for the placing and maintenance of barrels, and Section Foremen shall be responsible for keeping them filled with water at all times, except in severe winter weather, when the freezing of water would be likely to burst barrels. At such times they shall be emptied, removed from bridge decks, and stored.

BRIDGE AND BUILDING FOREMEN.

330. Bridge and Building Foremen will receive their instructions from and report to the Bridge and Building Masters.

331. They have charge of all work outlined herein for the Bridge and Building Master on their respective districts, unless relieved by the Bridge and Building Master.

332. They shall make requisition through the Bridge and Building Master for the necessary tools, material and supplies required.

333. They must see that the boarding and tool cars for their gangs are kept clean, neat in appearance, in good repair, that wholesome food is supplied, and that all refuse from these cars is properly disposed of and not thrown on the right-of-way.

334. They must see that all chimneys and stove pipes under their charge are regularly inspected and cleaned.

335. They must see that all tools are in proper condition.

336. They must personally supervise all work in their charge and see that their workmen faithfully perform their duties, and recommend to the Bridge and Building Master for dismissal or discipline anyone guilty of neglect, incompetency or misconduct.

337. They must not do work which would interfere with the safe passage of trains at usual speed without first displaying proper signals. (See Rule 49.)

338. Bridge and Building Foremen are expected to be familiar with all the rules, particularly those about watching, signals, slow orders, tie plates, spiking, elevation of the outer rail, gauging, standard plans, shimming, explosives, accidents, reports, hand and push cars, and be governed by them in performing their duties.

339. They must carry a reliable watch, and, when practicable, compare time each day with the clock at the nearest telegraph office, with the

Bridge and Building Master, or with the conductor of a train. They must carefully observe signals displayed by trains, and be sure that all trains and sections of trains that are due have passed, before obstructing the track.

340. They must have with them the latest time-table for the movement of trains, and must understand its use, and know the times of all regular trains at any point at which they may be working.

BRIDGE WATCHMEN.

341. Bridge and Snow shed Watchmen will receive their instructions from and report to the Bridge and Building Masters.

342. Their special duty is to see that the structures are safe for the passage of trains and to prevent the structures under their charge from being damaged by freshet and fire. They must be familiar with these rules, particularly those about track walking and inspection, signals and slow orders. (See Rules 326 and 360.)

343. They must insure that the water barrels on the structures under their charge are kept filled; keep the coping of abutments and piers clean, remove combustible matter from near the bridges and prevent driftwood from accumulating; frequently examine the wood and iron work, report any defect, and perform such other duties as the Bridge and Building Masters may direct.

MASONRY FOREMEN.

344. Masonry Foremen will receive their instructions from and report to the Bridge and Building Masters unless otherwise directed; they have charge

of all masonry renewals and repairs assigned to them.

345. They must personally supervise all work in their charge and see that their workmen faithfully perform their duties, and recommend to the Bridge and Building Master for dismissal or discipline anyone guilty of neglect, incompetency, or misconduct.

346. They must see that all materials are safely kept and properly and economically used. They must see that all tools are in proper condition; and that their boarding and tool cars are clean and have a neat appearance, and that all refuse from these cars is properly disposed of and not thrown on the right-of-way.

347. They must make requisition through the Bridge and Building Master for the necessary tools, materials and supplies.

348. They must perform all work in accordance with the standard plans and specifications, or plans and specifications specially prepared for extensive repairs or renewals.

FOREMEN OF PAINTERS.

349. Foremen of Painters will receive their instructions from and report to the Bridge and Building Masters; they will have charge of all painting, kalsomining, paper-hanging and lettering in their respective districts.

350. They must personally supervise all work in their charge and see that their workmen faithfully perform their duties, and recommend to the Bridge and Building Master for dismissal or discipline any-

one guilty of neglect, incompetency, or misconduct.

351. They must see that all materials in their charge are safely kept and properly and economically used. They must see that all tools are in proper condition; and that their boarding and tool cars are clean and have a neat appearance, and that all refuse from their cars is properly disposed of and not thrown on the right-of-way.

352. They must make requisition through the Bridge and Building Master for the necessary tools, material and supplies required.

353. They must see that all work in their charge is done in standard colours and in accordance with standard plans and instructions.

BRIDGE REPAIRS.

354. When performing work which breaks or obstructs the track or weakens any structure, and which makes the passage of trains at usual speed dangerous, Bridge Foremen will be governed by Rules 48 to 59 inclusive.

355. Each Bridge Foreman is authorized to make immediate repairs to any structure which he may find to be in a dangerous condition, reporting same promptly to the Bridge and Building Master, who will report the matter to the Resident Engineer and Superintendent.

356. Bridge and Building Masters are authorized to make immediate repairs to any structure which they find to be in a dangerous condition, reporting the same to the Resident Engineer and Superintendent.

357. All material must be carefully checked when received, and errors in shipment promptly reported. One piece of work must be completed before going to another, except in cases of emergency. Any work left unfinished must always be put in a safe condition.

358. Worthless material removed from structures must be burned, where provincial laws permit, and all fire must be extinguished before leaving the work. All serviceable material must be piled convenient for shipment, or be returned to district headquarters.

359. In case of storms and floods, Bridge Foremen must be on duty. They must insure as far as possible the safety of all structures in their districts.

360. In case of damage to a structure by storm or by fire, which may prevent the safe passage of trains, Bridge Foremen must promptly notify the Bridge and Building Master and the Train Dispatcher, giving number and location of the structure, and must at once display the prescribed signals (see Rules 48 to 59) and repair the damage.

361. In case of two or more bridge gangs being called to repair a damaged structure, in the absence of the Bridge and Building Master, the Foreman on whose district the work is being done, will have charge of same, unless otherwise ordered. Where foremen are not assigned to districts the Senior Foreman will have charge, unless otherwise ordered.

BUILDING CLEARANCES.

362. The following instructions must be observed in the location and construction of buildings and platforms:—

1st. The Standard height of Main and Branch Line passenger platforms above top of rail, is 5 inches, and the distance between edge of platform and gauge side of rail 3 ft. 0 in. All new Main Line Passenger Platforms shall be built to these measurements and old platforms shall be changed when renewals or heavy repairs are being made.

Before constructing new, or altering old platforms, the Bridge and Building Master shall ascertain from Resident Engineer whether or not a change in elevation of track is contemplated.

2nd. The tops of all freight platforms on side tracks for general use should be 4 feet above the top of the rail and follow the grade of the track. The edge of the platform should be 3 feet 3 inches from the gauge side of the nearest rail.

3rd. All Buildings and other structures having a height of more than 4 feet above top of rail, unless authorized by approved plans or by a special Order of the Board of Railway Commissioners, shall have a clearance of not less than 6 feet from the gauge side of nearest rail of any track.

PAINTING BRIDGES AND STRUCTURAL STEEL.

363. (*a*) All exposed structural steel in new bridges and buildings is to receive two full even coats of approved paint.

(*b*) Before receiving the first coat the steel is to be cleaned of all rust and scale by means of steel scrapers and steel brushes.

(*c*) The first coat is to be put on as soon after the cleaning process as practicable and in order to carry this out the work must be done in sections, and not all cleaned at one time.

(*d*) The second coat shall not be applied until the first is quite dry.

(*e*) At least once every year all the exposed structural steel is to be carefully gone over and all signs of scaling paint and rust is to be removed by steel brushes and steel scrapers, no matter how small the affected areas may be.

(*f*) The cleaned portions are then to receive the same treatment as new work.

(*g*) If the spots requiring cleaning are found to be so close together as to make it impracticable to repaint these without repainting the whole exposed surface, this latter should be done.

(*h*) In all cases the cleaning process and the placing of the first coat, is to be carried on under rigid inspection.

(*i*) All steel which is exposed to Engine gases, etc., must receive frequent and careful attention and be cleaned and painted when necessary to protect the steel from corrosion and the question taken up with the proper authority as to the use of special paint, etc.

(*j*) All steel which has been weakened by corrosion must be promptly reported.

PAINTING BUILDINGS.

364. The following rules will govern the selection and application of paints to buildings and other structures.

(*a*) Only standard C.P.R. paints shall be used (see specifications).

(*b*) Except in special cases, which must be approved by the Chief Engineer, colors will be applied as per standard color card.

(*c*) In painting old buildings the surface to be painted must be dry and clean and all dirt and grease removed by scraping and washing with soap and warm water or dusting brush. Blisters or cracks must be removed before applying the new paint. When old buildings have been patched with new wood work these new portions must be primed separately, and allowed to dry before a full surface coat is applied.

(*d*) New buildings are to have all knots and pitch streaks covered with shellac, before priming. After being primed all punched nail holes are to be stopped with putty. New work is to be primed and have two coats of color.

(*e*) For new work, shingles should be dipped before being laid.

(*f*) Blistering of painted surfaces is due to the following causes. Too much oil in the paint on surfaces exposed to much heat. The surface being damp when paint is applied. Too little time being allowed for one coat to harden before the next is applied when resinous portions of the wood are not properly prepared.

(*g*) Cracking is caused by using too little oil in top coats and too much in under coats.

(*h*) Brushes shall be clean and have such size of bristles or hair as will spread the paint or varnish uniformly.

(*i*) If paint supplied is defective in any respect report same on form M.W.S. 15.

(*j*) The paint must dry out with a uniform gloss, it must be uniform in color and be of sufficient thickness to protect material.

PUMPMEN.

365. (*a*) Pumpmen receive instructions from and report to the Bridge and Building Master and have charge of pumping stations as assigned.

(*b*) They shall be men of experience in firing boilers and operating pumps.

(*c*) They are responsible for the safe keeping and economical use of all supplies furnished for their stations.

(*d*) They must keep a proper supply of water in the tanks under their charge at all times.

(*e*) They are responsible for the proper care and maintenance of boilers, pumps and other machinery, which they must keep in neat and serviceable condition.

(*f*) They must be familiar with the use and purpose of all valves, try cocks, levers, etc., and in no case operate any such whose object and purpose they do not thoroughly understand.

(*g*) They must know the location of all steam and water pipes, so that in case of leaks or accidents the valves controlling the same may be properly used.

(*h*) They must not tamper with safety valves except for inspection purposes, when they shall be opened by carefully raising the lever and not by altering the position of the weight.

(*i*) They must wash out their boilers at regular intervals as instructed by the Bridge and Building Master, dates of same to be shown on pumpmen's monthly report.

(*j*) They must keep a careful record of all water pumped and of all coal, oil, waste, etc., used, and report the same on the proper form.

(*k*) New fires must not be started nor banked fires livened unless the water shows in the gauge glass and the try-cocks indicate that the glass shows the actual amount of water in the boiler.

(*l*) In trying these and other cocks, do not let any more water escape than is necessary. When boiler is working, the gauge glass should be about ¾ full, and pumpmen should frequently ensure that the glass is in communication with the water in the boiler at both ends, by using the try cocks as above.

(*m*) When renewing gauge glasses, see that the sockets are in line and the glands square with the glass at each end, otherwise when tightening the glass may break.

(*n*) A pump working properly should run at nearly uniform speed throughout the stroke and not start off quickly and then slow down. This latter action indicates that the pump is running too fast or is sucking air.

(*o*) The Bridge and Building Master will give instructions as to the speed of each pump, which shall not exceed 100 ft. per minute, as pumps running faster are wasteful of steam and do not pump as much water as when running from 60 to 90 ft. per minute. The speed of the piston is obtained by multiplying the number of double strokes per min-

ute by twice the stroke in inches and dividing by twelve.

(*p*) They should keep the outside of the pump and the foundation fairly dry. If this cannot be done by ordinary repairs, it should be reported to the Bridge and Building Master, who will remedy the defects.

(*q*) Pumpmen will receive special instructions from the Bridge and Building Master as to the method of starting and shutting down, also regarding delivery of water to points other than the tank.

(*r*) They shall report any leaks in tanks or pipes, also any water that is being wasted carelessly during the filling of locomotive tenders, giving number of locomotive, date and hour.

(*s*) In winter a low fire will sometimes be required in boilers to prevent freezing of water in pump. Bridge and Building Masters will instruct pumpmen when and how to place fire in boilers for this purpose.

(*t*) A dry boiler subjected to a hot fire will be ruined, and if water is admitted to a hot dry boiler an explosion will occur. In case of feed pump or injector not working and water in boiler becoming dangerously low, pumpmen must draw fire and make necessary repairs.

(*u*) Pumpmen shall give the care of boilers precedence over any other duties assigned, as steam boilers are a menace to public safety if they are not properly attended.

(*v*) Any failure in the water supply must be promptly reported to the Chief Despatcher and Bridge and Building Master.

FIXED SIGNALS.

400. DEFINITIONS.

(*a*) SEMAPHORE.—A device consisting of a movable arm supported on a pole. The signal indications are given by the position of the arm. At night an additional indication is given by lights of prescribed colors, corresponding to the positions of the arm. The arm is displayed to the right of the pole as seen from trains approaching in the direction in which it governs.

(*b*) BLADE.—That part of a semaphore arm which, by its position, gives the signal indications.

(*c*) SPECTACLE CASTING.—That part of a semaphore arm which by its position, determines the color of the light which gives the additional night indications.

(*d*) DISC SIGNAL.—A device consisting of a disc so supported that it may be displayed to view or withdrawn. The indications are given by the position of the disc. At night, an additional indication is given by lights of prescribed color, corresponding to the positions of the disc.

(*e*) POLE.—The upright to which a signal is directly attached.

(*f*) BRACKET POST.—An arrangement of main post with crossbeam upon which two or more poles are supported.

(*g*) TARGET SIGNAL.—A disc supported in such a way that it may stand either parallel with or at right angles to a track on which it governs movements.

The indications are given by the position of the disc. At night, an additional indication is given by lights of prescribed colors corresponding to the positions of the disc.

(*h*) Whenever a fixed signal is used of any form other than those herein described the rules governing its observance will be placed in the time-table.

401. GENERAL PRINCIPLES.

(*a*) The back view of a signal does not govern the movement of trains.

(*b*) The indication governing a main running track movement in the established direction will be given by a Home Signal.

(*c*) The indication for a main running track diverging movement in the established direction at a junction will be given by one of two Home Signals located one above the other on the same mast, the topmost signal will govern the superior route and the lower signal that of the secondary or inferior route.

(*d*) The indication for a diverging movement from the main track in the established direction to a secondary or side track will be given by a Dwarf Signal located to the right of and adjoining the track to which it refers and either at the foot of or opposite the Home Signal. The light on the Dwarf Signal corresponding to the Stop indication will be shielded off, the Home Signal alone giving the Stop indication and the Dwarf Signal the clear indication for the diverging movement.

(*e*) The indication for a reverse movement from the established direction on or from a main running track, or for a movement in either direction

on a side track, or from a side track to the main running track, will be given by a Dwarf Signal.

(*f*) Distant signals will give advance information in regard to one home signal only. When there is more than one signal on the Home Signal mast the Distant Signal will work in connection with the topmost signal.

402. A signal imperfectly displayed, or the absence of a signal at a place where a signal is usually shown, must be regarded as a stop signal, and the fact reported to the proper officer.

403. Lights must be used upon all fixed signals from sunset to sunrise, and whenever the signal indications cannot be clearly seen without them.

AUTOMATIC BLOCK SIGNALS.

501. DEFINITIONS AND INDICATIONS:

(*a*) BLOCK.—A length of track of defined limits, the use of which by trains is controlled by Block Signals.

(*b*) BLOCK SIGNAL.—A fixed signal controlling the use of a block.

(*c*) HOME BLOCK SIGNAL.—A fixed signal at the entrance of a block to control trains entering and using the block.

(*d*) A semaphore arm standing horizontal or a disc displayed indicates, "Stop." When in this position at night a red light is displayed.

(*e*) A semaphore arm 60 degrees below or 90 degrees above the horizontal or a disc withdrawn indicates, "Proceed." When in this position at night a green light is displayed.

(*f*) DISTANT BLOCK SIGNAL.—A fixed signal used in connection with a Home Block Signal to regulate the approach thereto.

(*g*) A semaphore arm standing 45 degrees above horizontal or a disc displayed indicates, "Proceed, prepared to stop at next signal." When in this position at night a yellow light is displayed.

(*h*) A semaphore arm 60 degree below or 90 degrees above the horizontal or a disc withdrawn indicates, "Proceed." When in this position at night a green light is displayed.

(*i*) The blade of an Automatic Block Signal Semaphore has a pointed end, the front is painted red with a white patch, the back is painted white with a black patch.

A lunar white marker light is placed on the pole 6 feet below and opposite to the signal light.

(*j*) INDICATOR.—A device (usually employed in connection with a switch) used to show the position of a signal to which it refers. A miniature arm or disc is displayed, which assumes the stop position when the home signal protecting the block is in the stop position or a train is closely approaching it. At main track crossovers, the indicators at the switch in each track relate to the signal protecting the block on the other track.

(*k*) AUTOMATIC BLOCK SYSTEM.—A series of consecutive blocks in which the signals are operated by electric, pneumatic, or other agency, actuated by a train, or by certain conditions affecting the use of the block.

502. Block signals control the use of the blocks, but do not affect the movement of trains under the

time-table or train rules, nor dispense with the use or the observance of other signals whenever or wherever they may be required. The protection afforded by the automatic signals does not relieve trainmen from protecting their trains as required by Rule 99 of the General Train Rules.

503. Block signals apply only to trains running in the established direction.

504. When a train finds a distant signal indicating caution, it must proceed under such control as to be able to stop before reaching the home signal. When a train finds a home signal indicating stop, it must stop before reaching the signal, and not more than 200 feet from it. It may then proceed at once with caution, prepared to find the track occupied, a car foul, a switch open, a broken rail, or other obstruction in the block.

505. When a signal is out of service, the fact will be indicated by bulletin. Trains finding a signal out of service, must, unless otherwise directed, proceed with caution to the next signal.

506. Signals and switch indicators which are in service and are evidently out of order, must be reported by wire to the Superintendent. Signals must be designated by the number on the signal pole, if possible, otherwise by their location, and reports must state the time at which it was observed.

A signal or indicator indicating stop or caution, when it should indicate proceed, must be reported. A signal indicating proceed, when it should indicate stop or caution, must be reported.

507. Whenever practicable, the position of all discs and semaphore arms by night should be observed to see that they correspond with the indications given by the lights, and any incorrect indication should be reported.

508. In order to avoid holding main track signals in the stop position, cars or engines must not be allowed to stand between an insulated rail joint and a main track switch.

509. Both switches of a crossover between main tracks must not be closed while a car or engine occupies the connection between the switches of the crossover.

510. Switches at which indicators are in service must not be opened while the indicator is in stop position, except under flag protection.

511. A switch must not be used except under protection, if the indicator fails to assume the stop position, when the switch is opened.

512. When a crossover is to be used, the switch in the track on which the train is standing must be opened first.

513. Where no switch indicators are provided, a train which is to enter a block from a siding or crossover may do so only under protection; and unless it is known that the track between the switch and the next block signal in advance is clear, it must proceed with caution to that signal.

STATION PROTECTION SIGNAL.

560. A signal used to protect trains occupying the main track at a station or in a yard, the normal indication of which is "proceed."

(*a*) A semaphore arm standing horizontal or a disc displayed, indicates "stop." When in this position at night, a red light is displayed.

(*b*) A semaphore arm 60 degrees from the horizontal or a disc withdrawn, indicates "proceed." When in this position at night, a green light is displayed.

(*c*) BLUE will be displayed in the back light of Station Protection Signal when the indication in the governing direction is STOP, and WHITE will be displayed in the back light when the indication in the governing direction is PROCEED.

FLAG STOP SIGNALS.

561. When flag-stop signals are of the semaphore type, the arm in a horizontal position, or a green and white light displayed, indicates that trains in either direction, scheduled to stop on signal, will make station stop.

INTERLOCKING SIGNALS.

601. DEFINITIONS AND INDICATIONS:

(*a*) INTERLOCKING. — An arrangement of switch, lock and signal appliances so inter-connected that their movements must succeed one another in a predetermined order.

(*b*) INTERLOCKING PLANT.—An assemblage of switch, lock and signal appliances interlocked.

(*c*) INTERLOCKING STATION.—A place from which an interlocking plant is operated.

(*d*) INTERLOCKING SIGNALS.—The fixed signals of an interlocking plant.

(*e*) HOME SIGNAL.—A fixed signal at the point where trains are required to stop when the route is not clear.

(*f*) A semaphore arm standing horizontal indicates, "Stop." When in this position at night, a red light is displayed.

(*g*) A semaphore arm 60 degree below or 90 degrees above the horizontal indicates, "Proceed." When in this position at night, a green light is displayed.

(*h*) BLUE will be displayed in the back light of the Home Interlocking Signal when the indication in the governing direction is STOP, and WHITE will be displayed in the black light of Home Interlocking Signal when the indication in the governing direction is PROCEED.

(*i*) The blade of a home signal has a square end, the front is painted red with a white band, the back is painted white with a black band.

(*j*) When a home signal is made part of an Automatic Block System, the arm will give indications in three positions, namely, "Stop," "Caution" and "Proceed."

(*k*) DISTANT SIGNAL.—A fixed signal used in connection with a home signal to regulate the approach thereto.

(*l*) A semaphore arm standing 45 degrees above horizontal indicates, "Proceed, prepared to stop at next signal." When in this position at night, a yellow light is displayed.

(*m*) A semaphore arm 90 degrees above the horizontal indicates, "Proceed." When in this position at night, a green light is displayed.

(*n*) BLUE will be displayed in the back light of Distant Interlocking Signal when the indication in the governing direction is PROCEED, PREPARED TO STOP AT NEXT SIGNAL; and WHITE will be displayed in the back light of Distant Interlocking Signal when the indication in the governing direction is PROCEED.

(*o*) The blade of a distant signal has a square end, the front is painted yellow with a black band, the back is painted white with a black band.

(*p*) When a distant signal is made part of an Automatic Block System, the arm will give indications in three positions, namely, "Stop," "Caution" and "Proceed." When so arranged the blade will have a pointed end.

(*q*) DWARF SIGNAL.—A low, small signal of semaphore type, used as a home signal, governing one or more diverging or unusual routes.

(*r*) A semaphore arm standing horizontal indicates, "Stop." When in this position at night, a red light is displayed, except where signal is located at the foot of or opposite to a home signal, when the red light will be shielded off.

(*s*) A semaphore arm 60 degree below or 45 degrees above the horizontal indicates "Proceed at low speed." When in this position at night, a green light is displayed.

(*t*) BLUE will be displayed in the back light of a dwarf signal when the indication in the governing direction is STOP, and WHITE will be displayed

in the back light of a dwarf signal when the indication in the governing direction is PROCEED.

(*u*) The blade of a dwarf signal has a square end, the front is painted red with a white band, the back is painted white with a black band. It is placed on a signal mast about two feet above the track.

(*v*) POT SIGNAL.—A small revolving signal, used to indicate the position of a switch or as a substitute for a dwarf signal.

(*w*) ROUTE.—The course of way taken by a train in passing from one point to another, especially a customary or predetermined course, or any one of several possible combinations of turn-outs or crossovers by which a train may travel through an interlocking plant.

(*x*) Occasionally a route signal is placed on the mast of a home signal. When so placed it is below the lowest arm of the high signal.

602. Interlocking signals, unless otherwise provided, do not affect the movement of trains under the time-table or train rules; nor dispense with the use or the observance of other signals whenever and wherever they may be required.

603. Signalmen will be instructed by the Signal Supervisor as to the proper operation and care of signal apparatus and by the Officer in charge of trains as to their movements.

604. A new interlocking plant or one that has been out of service may be placed in operation only when proper inspection has been made and written instructions are issued to all concerned by the Superintendent of each Railway Company interested.

605. When the operation of an interlocking plant is to be discontinued, all concerned must be duly advised by the Superintendent of each Railway Company interested. During the time an interlocking plant is out of service the semaphore arms and lights must be removed. Trains must then make crossing stop.

SIGNALMEN.

611. The normal indication of home and dwarf signals is "Stop," and the normal indication of distant signals is "Proceed, prepared to stop at next signal."

612. Levers or other operating appliances, must be used only by those charged with that duty.

613. Signal levers must be kept in the position giving the normal indication, except when signals are to be cleared for an immediate train or engine movement.

Signals must not be set for any route when cars or engines are standing between the derails of a conflicting route.

614. When the route is clear the signals must be cleared sufficiently in advance of approaching trains to avoid delay.

Levers must be tested before each regular train is due, to ascertain if the plant is in working order.

615. A signal must be restored so as to display the normal indication as soon as the train or engine for which it was cleared, has passed through the interlocking plant, unless the interlocking plant is equipped with gravity time locks or route locking

when it must be restored as soon as the train has passed it.

A signal must be changed to "stop" after the passage of each train, and a following train must not proceed until the signal is again changed to "proceed."

616. If necessary to change any route for which the signals have been cleared for an approaching train or engine, switches and derails must not be changed or signals cleared for any conflicting route until the train or engine for which the signals were first cleared, has stopped in rear of its signal.

617. A switch or facing point lock must not be moved when any portion of a train or an engine is standing on, or closely approaching, the switch or detector bar.

618. Levers must be operated carefully and with a uniform movement. If any irregularity indicating disarranged connections, is detected in their working, the signals must be restored so as to display the normal indication and the connections examined.

619. During cold weather, the levers must be moved as often as may be necessary to keep connections from freezing.

The use of salt is forbidden.

620. If a signal fails to work properly its operation must be discontinued and until repaired the signal secured so as to display the normal indication. Under such circumstances Signalmen must be governed as per Rule 623, and in addition will require all trains to make a full stop before giving hand signal to proceed. Signalmen giving pro-

ceed hand signals must use a green flag by day and a green light by night.

621. Signalmen must observe, as far as practicable, whether the indications of the signals correspond with the position of the levers.

622. Signalmen must not make or permit any unauthorized alterations or additions to the plant.

623. If there is a derailment, or if a switch is run through, or if any damage occurs to the track or interlocking plant, or if any part of an interlocking apparatus fails to operate properly the signals must be restored so as to give the normal indication, and no train or switching movement permitted until all parts of the interlocking plant and track liable to consequent injury have been examined and are known to be in a safe condition.

624. If necessary to disconnect a switch from the interlocking apparatus, the switch must be securely fastened and report made at once to the Superintendent.

625. During storms or while snow is drifting special care must be used in operating switches. If the force whose duty it is to keep the switches clear, is not on hand promptly when required, the fact must be reported to the Superintendent.

626. If any electric or mechanical appliance fails to work properly, the Superintendent must be notified and only duly authorized persons permitted to make repairs. All glasses in signals must be kept clean and any cracked or broken, promptly renewed.

627. When switches or signals are undergoing repairs, signals must not be displayed for any movements which may be affected by such repairs,

until it has been ascertained from the Repairman that the switches are properly set and secured for such movements.

628. Signalmen must observe all passing trains and note whether they are complete and in order; should there be any indication of conditions involving danger, the signalman must take such measures for the protection of trains as may be practicable.

629. If a signalman has information that an approaching train has parted he must, if possible, stop trains or engines on conflicting routes, clear the route for the parted train, and give the train-parted signal to the Engineer.

630. Signalmen must have the proper appliances for hand signaling ready for immediate use. When hand signals are necessary for switch movements, they must be given only after the switches have been properly set and fastened, and from such a point and in such a way that there can be no misunderstanding on the part of Engineers or Trainmen as to the signals, or as to the train or engine for which they are given.

Hand signaling includes the use of lamp, flag, torpedo and fusee signals.

631. If necessary to discontinue the use of any interlocking signal, hand signals must be used and Superintendent notified.

Whenever a home signal cannot be cleared, trains will be forwarded on Clearance Form "D."

632. Signalmen will be held responsible for the care of the interlocking station, tools, lamps and supplies; and of the interlocking plant, unless provided for otherwise.

633. Lights in interlocking stations must be so placed that they cannot be seen from approaching trains.

634. Lights must be used upon all interlocking signals from sunset to sunrise, and whenever the signal indications cannot be clearly seen without them.

635. If a train or engine overruns or disregards a stop signal, the fact, with the number of the train or engine, must be at once reported by telegraph to the Superintendent.

In all cases of apparent disregard of signals, the signalman must at once inspect the signals and see if correct indication was given.

636. Only those whose duties require it shall be permitted in the interlocking station.

When a signalman is relieved, he must make a transfer on the prescribed form and obtain thereon the signature of the signalman relieving him.

637. Fire protection apparatus and tools of whatever kind must be kept in their proper place and ready for immediate use. Heating apparatus, flues, floor registers, chimneys, etc., must be kept in good order and carefully watched to guard against fire loss. Oil, waste, lamps, fuel, etc. must be kept in the coal and oil shed.

Engineers and Trainmen.

661. Trains or engines may be run to, but must not be run beyond, a signal indicating stop.

Dwarf signals (and lower arm of two arm high signals) frequently govern more than one route.

When the right to proceed is given by such signals, Engineers must observe carefully which route is set.

When a distant signal indicates caution, a train passing must be under control and prepared to stop before reaching the home signal.

662. If a clear signal, after being accepted, is changed to a stop signal before it is reached, the stop must be made at once. Such occurrence must be reported to the Superintendent.

663. Engineers and Trainmen must not accept clear hand signals as against fixed signals until they are fully informed of the situation and know that they are protected. Where fixed signals are in operation, Trainmen must not give clear hand signals against them.

Hand signals may be accepted for switching movements if given in such a way that there can be no misunderstanding as to the train or engine for which they are intended. Whenever the home signal cannot be cleared, trains will be forwarded on Clearance Form "D."

664. The Engineer of a train which has parted must sound the whistle signal for "train-parted" on approaching an interlocking station.

665. An Engineer receiving a train-parted signal from a signalman must answer by the whistle signal for "train-parted."

666. When the train has been re-coupled, the signalman must be notified.

667. Grates must not be shaken, ash pans cleaned, nor sand used or in freezing weather injectors allowed to overflow over any part of an interlocking plant.

668. Conductors or men in charge of yard engines must report to the Superintendent any unusual detention at interlocking plants.

669. Trains or engines stopped in making a movement through an interlocking plant, must not move in either direction until they have received the proper signal from the signalman.

670. Running switch movements must never be made within an interlocking plant.

671. Engineers should, whenever possible, observe the position of all semaphore arms by night and endeavor to see that they correspond with the indications given by the lights.

672. When an interlocking plant is out of service temporarily, trains must be brought to a stop before reaching the home signal, and will proceed only when the switches and derails are known to be properly set, and upon receiving hand signal from the signalman on the ground that the way is clear.

673. When a train is run against the current of traffic, it must stop before crossing any railway crossing or drawbridge, designated in the time-table, even though interlocking devices are used; and not proceed until the way is known to be clear.

RULES GOVERNING THE USE OF SEMAPHORE SIGNALS.

674. In the erection of semaphores observe the following:

(*a*) On single track and double track operating to the right, semaphores shall be placed on the right of the track and arms shall be displayed to the

right of the pole as seen from trains approaching in the direction in which they govern. Poles are not to be located closer than 8 feet from the nearest rail.

(*b*) On double track operating to the left, semaphores shall be placed on the left of the track and arms shall be displayed on the left of the pole as seen from trains approaching in the direction in which they govern.

(*c*) When main running tracks are so situated that sufficient space cannot be obtained to admit of the signal masts being located adjoining the track which they govern, the masts may be located either on a signal bridge directly over the centre of the track they govern or on a bracket post.

(*d*) When parallel tracks are to be governed the masts carrying the signals governing them should stand in the same relative positions as the tracks governed. On bracket posts, signals on the right hand must refer to the main running track farthest to the right, the signals on the next mast to the left refer to the main running track to left of the first mentioned track, and so on for each main running track operated in the same established direction.

(*e*) Posts supporting wires shall be of an even height of 4 ft. above base of rail, parallel thereto, 40 ft. apart, and not less than 8 ft. from nearest rail.

(*f*) Railway, highway or farm crossings not more than 20 ft. in width shall be crossed by underground wires passing through a wooden box with an opening of 3½ inches square placed as near the surface of the ground as practicable.

(g) Where wires cross highways more than 20 ft. in width or a number of tracks, such as in yards, they must run in ½-inch galvanized iron pipe provided with a stuffing box at each end, pipe to be filled with a mixture of coal oil and black oil in equal parts.

675. The use of semaphores as station protection signals is restricted to such points as are approved by the General Superintendent.

676. Standard semaphore will be used at junctions, railway crossings and drawbridges not protected by interlocked plants.

SIGNAL REPAIRMEN.

677. Repairmen are responsible for the inspection, adjustment and proper maintenance of all the interlocking plants, highway crossing bells, non-interlocked semaphores, highway crossing gates, etc., assigned to their care.

678. Where the condition of switches or track does not admit of the proper operation or maintenance of interlocking plant, the fact must be reported to the Superintendent.

679. When any part of an interlocking plant is to be repaired, a thorough understanding must be had with the signalman, in order to secure the safe movement of trains and engines during repairs. The signalman must be notified when the repairs are completed.

680. Alterations or additions to an interlocking plant may be made only upon proper authority and plans approved by the Signal Engineer. (See also Rule 31.)

681. Repairmen when on duty, or subject to call, must keep the proper officer advised as to where they can be found, and respond promptly when called.

List of Tools for Signal Repairmen.

682. 1 Portable forge, 30″ x 30″ fire box, 10″ fan blower, no hood.
1 150 lbs. anvil.
1 Pipe cutter to cut ½″ to 1″ pipe.
2 Dies for 1″ pipe.
1 Die for ¾″ pipe.
1 Pipe stock for above dies.
2 1¾″ Adjustable pipe tongs.
1 12 lbs. sledge and handle.
1 Canvas tool bag.
1 No. 5 Champion drill press three-geared 20″ swing with ⅝″ straight hole for drill in shaft.
1 No. 2 Westcott's Little Giant Drill chuck with ⅝″ shank jaws to hold up to 1″.
500 ft. ¾″ manilla rope.
1 double block for ¾″ rope.
1 single block for ¾″ rope.
1 Stillson wrench, 14″.
1 Reamer, ⅞″.
2 14″ flat files.
1 ½″ round file.
1 ⅝″ round file.
1 Ratchet drill.
1 Combination pipe vise to hold up to 2″ pipe, jaw to be 4″ wide.
2 ¼″ Twist drills ⅝″ straight shank.

2 ⅜" Twist drills ⅝" straight shank.
2 ½" Twist drills ⅝" straight shank.
2 11-16" Twist drills ⅝" straight shank.
2 13-16" Twist drills ⅝" straight shank.
2 ⅞" Twist drills ⅝" straight shank.
2 1 1-16" Twist drills ⅝" straight shank.
2 1¼" Twist drills ⅝" straight shank.
2 11-16" Twist drills for ratchet square shank.
2 13-16" Twist drills for ratchet square shank.
1 pr. 1¼" round-nose blacksmiths' tongs.
1 pr. ¾" round-nose blacksmiths' tongs.
2 pr. 1¼" flat-nose blacksmiths' tongs.
1 1¼" top swage.
1 1¼" bottom swage.
1 Hot chisel and handle.
1 Cold chisel and handle.

SIGNAL MAINTAINERS.

683. Signal maintainers report to and receive instructions from the Superintendent.

684. They have charge of the maintenance of Automatic Block Signals, interlocking plants and highway crossing bells on the territories assigned to their care and are responsible for their proper working. They must conform to the rules and instructions for the signal repairmen.

685. They will report to the Superintendent any improper working of the signal system. Alterations or additions to the signal system must not be made unless authorized by the Superintendent.

686. When the signal system is out of order, they must report to the Superintendent immediately when repairs have been made and the system restored.

687. Maintainers when on duty, or subject to call, must keep the proper officer advised as to where they can be found, and respond promptly when called.

688. They must keep a proper set of tools in readiness for emergency calls.

689. They must make a close inspection of all bond wires and clean all motor commutators at least once every week.

690. They must make tests with voltmeters at the insulated rail joints at fouling points on all siding turnouts at least once in two weeks to insure that the track circuit is being maintained to this point.

They shall at the same time make a test on switch instruments and insure that shunt wires are intact and working properly.

691. They must keep section foremen supplied with all material necessary for the maintenance of track bonding and insulated joints.

HIGHWAY CROSSING BELLS.

Maintenance and Inspection.

692. Keep the track battery strong and in good order, inspecting same semi-monthly.

(*a*) A gravity cell deteriorates through the action of the blue vitriol solution upon the zinc element, forming a whitish solution of zinc sulphate. When the line of demarkation is central, the cell is prime. If the white solution gets too near the vitriol, draw off some of the zinc sulphate by means

of a battery syringe and add soft water and vitriol. If the copper sulphate gets too high, draw off some of the blue solution and replace by water, care being taken to wash the zincs and scrape all connections in every case.

(*b*) Watch the track and keep the insulation good. If gravel, cinder, or dirt ballast is used, do not allow it to lay up over the base of the rails, which will cause leakage. Test the insulated joints to insure their good condition. Look after the bondwires and taps where insulated wires lead off from track. These often are broken or corroded off when it is apparent only upon trying the wire by a slight pull.

(*c*) If bondwires are put between the splice bars and the rail, be especially watchful along damp or wet track. A broken bond behind a splice may open up, in the hot hours of the day and close again in the cool of the night, thereby making an intermittent failure sometimes hard to find.

(*d*) Allow slack wire in bends, in trunking.

(*e*) Do not use soldering salts to corrode the joint. Use non-acid soldering compound that will not injure the wire.

(*f*) Do not use gas pliers or other heavy instruments on the thumb screws or binding post of relays, bells, lighting arresters, etc. They are not constructed to stand rough treatment.

(*g*) In fastening lightning arresters to support, be sure to get a good even bearing, or the porcelain core will break.

(*h*) Keep all the apparatus well painted to preserve it from rust and decay.

(*i*) In case of trouble, localize the fault and then test out. Do not hunt at random. If the track relay is working, the fault is beyond the track and its connections.

(*j*) Sweep your hand lightly over your battery connections to pick out the weak ones, usually due to corrosion on account of creeping salts.

INSTRUCTIONS FOR CHARGING TRACK BATTERIES.

693. Set up the copper and zinc elements in the cell, put in about two lbs. of copper sulphate (blue stone) and fill up with clean water until the zinc is covered; let the cell stand about 24 hours.

(*a*) By the action of the zinc on the copper sulphate solution, zinc sulphate is soon formed around the zinc, and the cell is ready for use. The maintenance of this cell is simple, it being only necessary to renew the supply of copper sulphate when the solution becomes weak, which is indicated by the fall of the blue-coloured liquid below the top of the copper element.

(*b*) If the cell is desired for immediate use, a solution of zinc sulphate may be prepared and poured into the jar with the copper sulphate solution; in this case the zinc should not be placed in position until the two liquids have separated, which will be indicated by the upper part of the liquid becoming nearly colorless, while the lower part is of a deep blue color.

INSTRUCTIONS TO BE OBSERVED IN CASES OF PERSONAL INJURY.

700. The injured person should not be moved until it is known what part is injured.

701. Hemorrhage must receive the first attention, no matter what are the other injuries.

702. When there is a wound, it should be covered with a clean dressing and bandage.

703. A written despatch or telegram should be sent at once to the nearest railway surgeon, giving as full particulars as possible regarding the nature of the injuries and the condition of the injured man.

704. Bystanders should not be permitted to crowd about an injured person.

705. It is best not to administer alcohol, except on the advice of a doctor. If necessary, hot tea, coffee, milk, or a small quantity of Sal Volatile, in water, may be given.

706. In moving an injured person, a stretcher should be used, if obtainable, any injured limb being carefully supported. A temporary stretcher may be made by turning the sleeves of a coat inside-out, and passing a broom handle or pole through each sleeve and buttoning the coat. On this the patient may be carried with his back against the front bearer. If a longer stretcher is required for a patient unable to sit up, several coats may be treated in this manner. If desired, the poles may be kept apart by strips of wood lashed to the ends of the stretcher.

HEMORRHAGE.

707. It is most important that bleeding be controlled, and a patient's recovery often depends on the promptness with which this is done. Employees should note the *pressure points on the diagram*, study the course of the arteries, and practise the stopping of the flow of blood on their own or friend's limbs.

Arterial Hemorrhage:—The blood is bright red in color and may come out in spurts. The pressure point is on the heart-side of the wound.

TREATMENT:—(1) Place the patient in a suitable position, lying down.

(2) Elevate the bleeding part.

(3) Expose the wound.

(4) Apply digital pressure (Figs. 2 and 3) if the wound is small on the bleeding spot; if the wound is large on the pressure-point next to the wound on the heart side.

(5) Remove foreign bodies, such as broken glass, pieces of clothing, etc., seen in the wound. Do not search for foreign bodies not seen.

(6) Cover the wound with a clean and firm absorbent dressing,—a pad of lint, linen, or a folded clean handkerchief.

(7) Bandage tightly over the dressing, unless foreign bodies are suspected to be in the wound, or unless there is danger of causing injury to a fracture, in which case a light dressing only should be applied.

(8) Apply a pad and bandage (Tourniquet: Fig. 4) on the pressure point, but only in the following

cases:—As a temporary measure while the wound is being exposed, examined and covered; or as a more permanent measure when bleeding cannot be stopped by the pad and bandage on the wound.

(9) Afford support to the injured part.

Venous Hemorrhage:—The blood is dark red in color and flows in an even stream. The pressure point is below the wound (side furthest from the heart).

TREATMENT:—Note Rules 1, 2, 3, 5, 6 and 7, as given for treatment of Arterial Hemorrhage.

Remove any constrictions, such as collar or garters, from the heart-side of the wound.

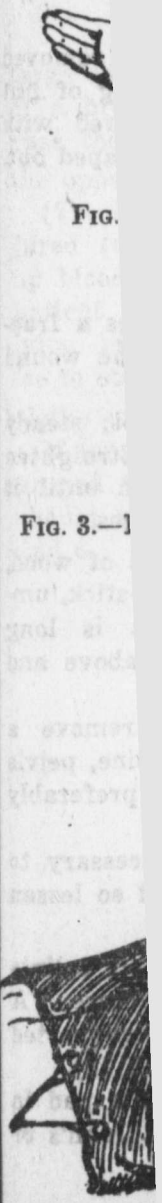
Digital pressure should be made on the wound until it can be covered by a pad and tight bandage. If this does not stop the bleeding, apply pressure near the wound on the side from the heart; in a wound of a varicose vein, it may also be necessary to apply pressure on the vein immediately above the wound.

SHOCK.

708. Lay the patient on the back with the head low. Loosen tight clothing. Provide for a free circulation of fresh air. Restore the heat of the body by covering the patient with coats or blankets. Give hot tea, coffee, milk or Sal Volatile (a teaspoonful in half a cup of water), and speak cheering words. If breathing cannot be discerned apply artificial respiration. (Schafer's Method.)

BURNS.

709. Carefully remove the clothing, cutting around any stuck to the skin, soak well with Olive,



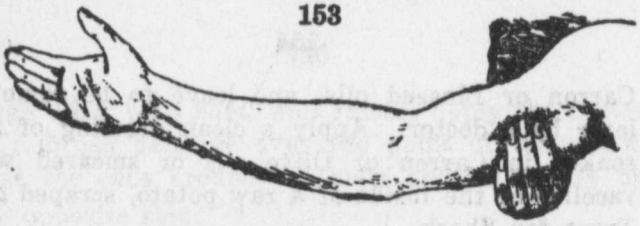


FIG. 2.—Digital compression of brachial artery.

FIG. 3.—Digital compression of radial and ulnar arteries.

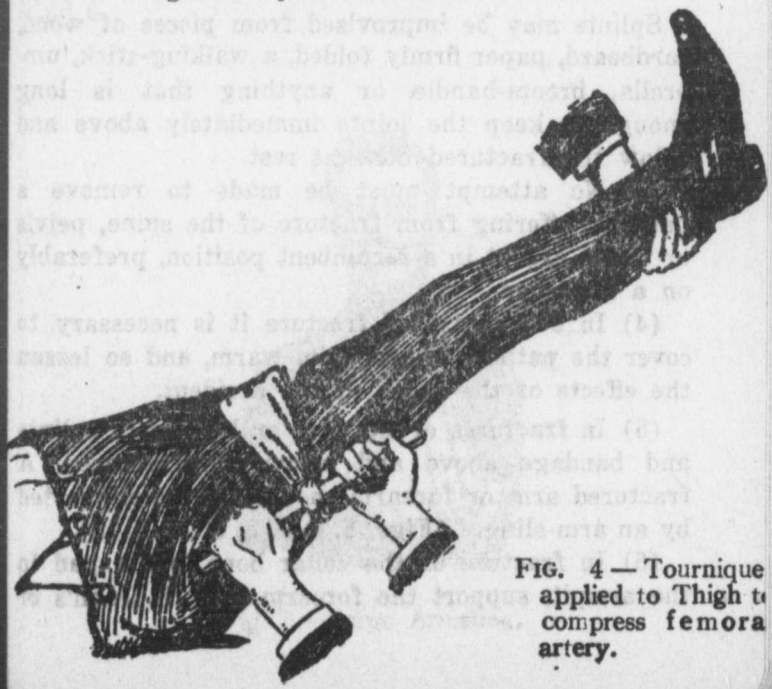


FIG. 4 — Tournique applied to Thigh t compress femora artery.

Carron or Linseed oils, and leave to be removed later by a doctor. Apply a clean dressing of lint soaked in Carron or Olive oils or smeared with vaseline or the inside of a raw potato, scraped out. Treat for Shock.

FRACTURES.

710. (1) When hemorrhage accompanies a fracture, it must be attended to first, and the wound covered by a clean dressing.

(2) Attend to the fracture on the spot; steady and support the injured limb at once. Straighten it with great care, and hold in position until it has been secured by splints and bandages.

Splints may be improvised from pieces of wood, cardboard, paper firmly folded, a walking-stick, umbrella, broom-handle or anything that is long enough to keep the joints immediately above and below the fractured bone at rest.

(3) No attempt must be made to remove a patient suffering from fracture of the spine, pelvis or thigh, except in a recumbent position, preferably on a stretcher.

(4) In every case of fracture it is necessary to cover the patient to keep him warm, and so lessen the effects of the shock of the accident.

(5) In fractures of the arm or leg, apply splints and bandage above and below the fracture. A fractured arm or forearm should also be supported by an arm-sling. (Figs. 5, 6, 7, 8, 9, 10 & 11).

(6) In fracture of the collar bone, put a pad in the armpit, support the forearm in a St. John's or

large sling with hand well raised, apply the centre of a broad bandage over the point of the elbow, pass the ends around the body and tie tightly on the opposite side.

(7) In fracture of the ribs, if the lung is injured (usually indicated by the patient coughing up blood) do not bandage the chest, but place the patient in the most comfortable position, usually lying down inclined towards the injured side. Give ice to suck if conscious, and apply ice or cold water cloths over injury.

If lung is not injured, apply two broad bandages around the chest, and in both cases the forearm should be supported in a large armsling. Figs 5 and 6.

Fig. 5.—Large Armsling.

FIG. 6.—Small Armsling.

FIG. 7.—Fracture of Upper-arm.

FIG. 8.—Fracture of Fore-arm.

Fig. 9.—Fracture of Thigh.

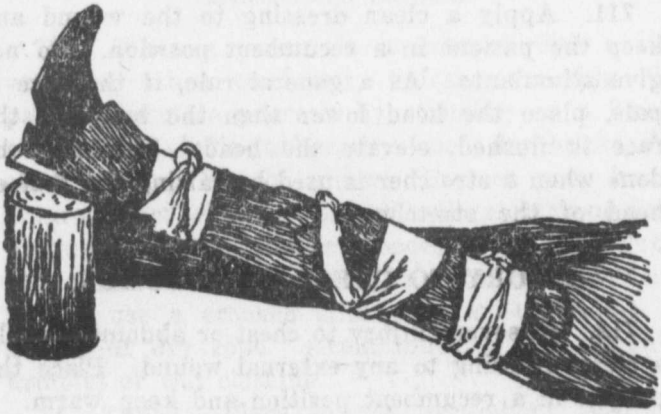


Fig. 10.—Fracture of Knee-cap.

Fig. 11.—Fracture of Leg below the knee.

8. Fracture of the spine is usually accompanied by paralysis and loss of sensation in the limbs below the injury, and the patient should be kept at rest in a recumbent position and kept warm. Do not attempt to remove the patient without using a stretcher.

INJURIES TO HEAD.

711. Apply a clean dressing to the wound and keep the patient in a recumbent position. Do not give stimulants. As a general rule, if the face is pale, place the head lower than the body; if the face is flushed, elevate the head. This may be done when a stretcher is used by raising the foot or head of the stretcher.

INJURY TO CHEST OR ABDOMEN.

712. In severe injury to chest or abdomen, apply a clean dressing to any external wound. Place the patient in a recumbent position and keep warm.

INSENSIBILITY.

713. Arrest hemorrhage if apparent. Place the patient in the recumbent position. Do not attempt to give anything by the mouth while unconscious. Unfasten tight clothing. Provide fresh air. When conscious, give warm tea or coffee, if there is no bleeding. If necessary, apply artificial respiration (Schafer's method). If in state of convulsion, support the patient's head; keep him from biting his tongue and striking objects near him, but do not completely check his movements.

FROST BITE.

714. Do not bring the patient into a warm room until, by friction with the hand and rubbing with soft snow, sensation and circulation in the affected parts are restored. When circulation is restored, keep the patient in a room at a temperature of 60 degrees.

ELECTRIC SHOCK.

715. When a person is in contact with a live wire or other conductor, before removing the patient, insulate yourself by standing on a "non-conductor,"—india-rubber, dry wood, dry bricks, dry cloth, or dry hay or straw. Protect your hands from contact with the patient or the electric medium by rubber gloves, rubber tobacco pouch, dry clothing, or a folded newspaper; if none of the above are handy, use a crooked stick (not an umbrella) or a loop of dry rope. Avoid touching the patient's armpits or wet clothing.

TREATMENT:—Place in the recumbent position. Unfasten all tight clothing, flick face and chest with wet towel. Provide fresh air. Apply artificial respiration. (Schafer's method). Treat for burns and shock.

ARTIFICIAL RESPIRATION.

(Schafer's Method.)

716. (1) Waste no time in loosening or removing clothing.

(2) Lay the patient in a prone position (*i.e.*, back upwards) with his head turned to one side, so as to

FIG. 12.—Expiration.

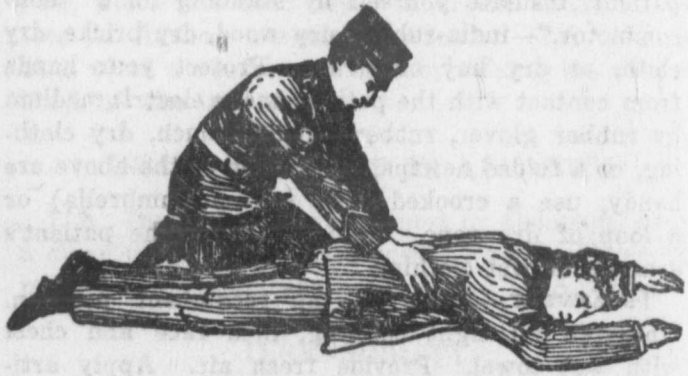


FIG. 13.—Inspiration.

keep his nose and mouth away from the ground. No pad is to be placed under the patient, nor need the tongue be drawn out, as it will fall naturally.

(3) Kneel at one side, facing the patient's head, and place the palms of your hands on his lowest ribs, one at each side, the thumbs nearly touching one another in the small of the back. Leaning your body forward, slowly apply firm, but not violent, pressure straight downwards upon the back and

lower part of the chest, thus driving air out and producing expiration. Draw back your body somewhat more rapidly and relax the pressure, but do not remove your hands; this produces inspiration. Figs. 12 and 13.)

(4) Alternate these movements by a rhythmic swaying backwards and forwards of your body, twelve to fifteen times a minute, persevering until respiration is restored, or a doctor pronounces life to be extinct.

(5) When breathing is restored promote warmth and circulation by covering with dry warm clothing and rubbing body and limbs energetically toward the heart, afterwards when patient is able to swallow, give hot drinks as tea, coffee or milk.

SURGICAL APPLIANCES.

717. A "First Aid" box is carried on all trains, for use in case of accident or emergency. Instructions will be found in the box regarding the use of its contents.

FIRST AID LECTURES.

718. Employees are urged to join one of the First Aid classes in connection with the Company's St. John Ambulance work. The lectures are free to all employees, and are followed by practical demonstrations by First Aid Instructors.

APPENDIX

SUPPLEMENTARY INSTRUCTIONS

covering the systematic handling of track work, &c.

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MAINTENANCE OF ROADBED AND TRACK.

General.

The importance of maintaining roadbed and track in perfect condition should be fully realized by all Maintenance of Way employees. Only where track is kept in first class condition is it possible to operate trains with speed, comfort and safety.

Work necessary to properly maintain track may be systematised so that the various duties can be regularly attended to at certain seasons of the year.

Section foreman must at all times know that his outfit of track tools is complete and in proper condition for use, picks and bars should be kept sharp, levels and gauges regularly tested, and such tools as are found to be damaged or unfit for further use should be disposed of in accordance with instructions in Maintenance of Way Rules. He must know what equipment he needs sufficiently in advance of the time such tools are required for use, and place requisition so that it can be filled before the articles called for will be required.

When thaws occur and in the early Spring when snow melts during the day and freezes up again at night, special attention must be given to the opening up of waterways so that all water will be carried out of the ditches and away from the track as rapidly as possible. If the water does not get a quick run off it will freeze at night in the ditches, and the ice thus formed will gradually accumulate until the ditches are full, the thawing of this ice will saturate the roadbed with water

and track will go out of surface and become rough riding.

SHIMMING.

Heaving of track is caused by the freezing and consequent expansion of water which is absorbed and retained by the earth and ballast of which roadway is composed; therefore any improvement in drainage will reduce amount of shimming necessary.

Shims will be supplied to standard dimensions with holes bored through them so that the spikes may be driven without splitting the shim; when shimming, tie plates should be removed and the shims placed upon the ties square to the rail.

If the tie plates have the "Sellers" base or are of a type with shallow flanges they should be used on top of the shims.

Where shimming is required to a height of one inch or over, the rail must be thoroughly braced in accordance with Maintenance of Way Rules. It must be remembered that the depth of the spike in the tie diminishes as the thickness of the shim increases, accordingly the holding power of the spike is reduced and owing to this the side thrust of trains has a greater tendency to bend the spikes, which causes the spreading or widening of the gauge; standard shimming spikes should therefore be used, in accordance with standard instructions, and also braces, to secure proper holding power.

The driving of shims at an angle between the spikes weakens the track and is prohibited.

As track begins to heave a "run-off" should be shimmed on each side of the high points, using at the start a standard ¼" shim and increasing the depth of shim by quarter inches until the surface has been equalised. No attempt should be made to compensate for heaving by adzing the ties as this practice reduces their strength and rapidly destroys them. Care must be taken to see that the surface of the tie, shim, and rail base are entirely free from ice or snow, as track is liable to spread if there is ice between the bearing surfaces.

When shimming to the extent of 1½" or more is done, shims must be used in the 24" length and have two additional holes bored in them so that they may be spiked securely to the ties. When it is necessary to shim over 2½" the standard 3" x 7" x 7' long shim must be used extending right across the track under both rails, it should be bored to receive the rail spikes and also additional spikes to hold it in place, if necessary smaller shims may be used on the top of these 3" shims the same as if used on the track tie.

Trackmen cannot be too strongly impressed with the fact that constant attention to, and improvement of, drainage is the only way to remove the necessity for shims and that time spent in improving drainage will save a great deal more time in shimming track. "

REMOVING SHIMS.

A very important part of the Section Foreman's work during thaws and while the frost is finally

leaving the ground, is to change or remove shimming from the track when necessary, as nearly as possible in the reverse order in which it was placed, not all at one time, but by successive stages. Instead of raising and tamping the low places between any two easements caused by the frost leaving the ground, the heavy shims can be successively replaced by smaller ones, thus keeping the track in fair surface and so gradually restoring it to normal condition.

Each time spikes are drawn when changing or removing shims the old spike holes must be plugged and the spikes redriven in the plugged holes as often as good holding power can be secured in this way, otherwise ties where much shimming has been done will be destroyed by "spike killing" in a very short time.

When the section force has succeeded in freeing the roadbed from all surface water, and as soon as all frost is out of the ground, the next important work to be done is to remove all remaining shims from the track. At points where track does not return to its original level after the frost is all out of the roadbed, and shims are still necessary to keep it in surface, the high points must be dug down to proper level, the shims removed, and a good surface secured in this way rather than by attempting to raise the long intervening sections to the level of these high points, and all ties that may have been disturbed in re-surfacing these places in the track must be solidly tamped to furnish a firm support for the rails. Places where extreme heaving has taken place should be carefully watched as broken rails are liable to occur at such points.

FIRST WORK AFTER REMOVING SHIMS.

When the work of removing shims from the track is complete the section should be gone over, the worst of the low places, joints, etc., picked up and as good a general surface given to the track as is possible without needless delay. The general line of track should always be watched while attending to the surfacing and no points should be allowed to remain out of line.

The first general attention to be given to the track after removing shims and picking up the worst low spots should include the checking of gauge, tightening of bolts, redriving spikes where necessary, cleaning up ditches, burning of dry grass and stubble on the Right of Way, trimming up road crossings and such rough repairs to and straightening up of cattle guards, fences, track signs, etc., as will put them in serviceable condition until systematic and thorough attention is given to the track later in the season; this preliminary attention should also cover such work as may be required to put side tracks in order, and to clean up from yards and station grounds the accumulated rubbish of Winter.

RENEWING TIES.

In the spring of the year as soon as the snow is off the track, Roadmaster must select from his Section foremen the man whom he considers in knowledge of ties and track conditions best fitted for the work of tie inspection, fully instruct him and send him over the Subdivision to mark with a spot

of red paint ties which in his judgment ought to be replaced during the season; this inspector must be provided with a standard tie testing hammer and must test with this all questionable ties; only such ties as are marked by this inspector will be renewed without further authority. On completion of his inspection, Tie inspector must report to the Roadmaster the number of ties marked for renewal in each mile so that proper distribution of the new ties may be arranged. If section foreman considers necessary the renewal of ties not marked by the inspector, he must take the matter up with his Roadmaster who will, after personal inspection, decide whether the ties in question will be renewed.

Tie renewals should be made by beginning at the far end of the section, and continued through to the other end of the section with as much regularity as possible, always full spiking track to perfect gauge throughout, maintaining surface and line where track is disturbed in making renewals, and tamping all new ties to a solid bearing. New ties must always be fully spiked as soon as they are put in and track must not be left overnight without being properly filled in and roughly trimmed.

If the work of renewing ties is properly carried on it should be completed by about the first of June, leaving the summer and fall free for the maintenance work required to put track in first class condition to go through winter. When all tie renewals have been made, general surfacing, lining, and other maintenance work should be systematically carried out.

SURFACING, LINING AND GAUGING.

Beginning at the far end of the section, surfacing, gauging, and lining should be carried through the entire section; the work being done "out of face" and carried on so that it will be all completed each day for the amount of track covered. Main line track should be the first to receive attention, following which side tracks may be attended to in the same manner. The track level and gauge must be used constantly when surfacing track to ensure that corrections of surface and gauge are accurately made. No more lift should be given to track in general surfacing than is required to bring the low portions up to a uniform grade between the high spots; the reason for this is that track has more chance to settle and to acquire an uneven surface where a high lift has been made than where the greater portion of the roadbed has been left undisturbed and where only as much new ballast is placed as can be firmly packed by using a tamping bar. The solidity of the roadbed depends upon how well the surfacing ballast has been tamped under the ties and how little the old ballast in the track has been disturbed. All ties must be tamped throughout their length, but must not be tamped to as firm a bearing in the centre as under the rails; doing this causes what is known as "centre bound" track, and if the tamping at the centre of ties is firmer than at the ends, the track will "rock" on this centre when trains pass over it, thereby destroying line and surface.

Before any lifting is done, all spikes should be driven down snug against the rail, so that after lifting it will not be necessary to hold loose ties up against the rails while tamping. Trackmen should never raise the general surface of track unnecessarily. This practice is not only wasteful of ballast but deprives the track of the effectiveness of a full shoulder at the ends of the ties.

The superelevation and extra gauge on curves must be handled in accordance with Maintenance of Way Rules and Instructions, and it is very important that the superelevation and extra gauge marked on the standard "elevation posts" be strictly adhered to. The inner rail of track must be maintained at grade and the proper curve superelevation must be obtained by raising the outer rail.

The track level should be carefully tested each time it is used to make certain that it is in perfect adjustment.

Line and gauge are as important as surface, and if not properly maintained the track will soon become unsafe.

Where track is badly out of line over long stretches, centre stakes should be set by the Engineer as a guide.

In lining track the foreman should first stand far enough from his men to get a general view of the track; after having roughly lined it from this point he should then stand about six to seven rail lengths from his men, so that he can see all short kinks in the line, can direct the men in their work, and prevent the general line from being disturbed.

After track is lined it should be put in perfect

gauge. The line-side should be considered fixed, and left undisturbed while all spike pulling and re-driving should be done along the opposite rail which may, for convenience, be called the gauge side of the track.

Before moving the rail all spike holes must be plugged, and when re-spiking the gauge must be laid square across the track, close to the point where spikes are being driven, and the rail held firmly up to gauge.

As the general surfacing, lining and gauging of track progresses, all signs such as elevation, whistle, and culvert posts, crossing signs, etc., up to the point where the work for each day ends, should be straightened up and put in good repair. Cattle guards, crossings and return fences should be put in proper condition and right of way fences and snow fences repaired. Ballast should be dressed to standard section, and the grass line clearly defined at a uniform distance from the track.

MISCELLANEOUS MAINTENANCE WORK.

The general Maintenance work so far outlined is such as should receive the first and most thorough attention during the Spring and early Summer months. There is, however, much work connected with roadbed and track which should be repeatedly done during the year. Broken spikes, bolts, angle bars, and rails are likely to be found at any time and must be constantly watched for and at once replaced. Loose bolts must be tightened, loose spikes drawn, the holes plugged and the spikes re-

driven. Ties that are placed in the track as renewals must be retamped to secure a firm bearing for the track. Loose joints must be watched for and remedied. Low joints must be raised, for if allowed to remain, they are very destructive to the track in general. Bolts soon become loose or broken in such joints unless the ties at these places are firmly tamped. All ties should be kept straight in the track at right angles with the rails.

The creeping of rails is a source of trouble in maintenance of track and must be carefully watched for and corrected. Spiking joints in slots punched in the flanges of angle bars retards the creeping tendency and rail anchors secured to the rails and firmly resting against the ties are an additional help. On bridges, the joints must not be spiked in the slots of angle bars as the pull of the creeping rail might disturb the bridge deck.

Particular attention must be given to the adjustment of switches, all bolts kept tight, particularly in the No. 1 and connecting rod joints, as otherwise lost motion will occur; and frogs must be kept tightly bolted at all times. The head blocks of switches must be kept firmly tamped and switch stands securely bolted to the head blocks. Perfect line and surface must be maintained at switches, and gauge must be kept true and accurate to dimensions shown on standard switch layouts, connecting rods and pins in place and secure, point rails working freely and fully bolted with all nuts tight. Proper attention should be given all these matters and such repairs made as are necessary to restore every part to standard condition.

In the Fall of the year, while the last cleaning up is being given to ditches, etc., low places in the track, low joints, and loose ties, etc., should be looked for and when detected should be put in proper condition. If these things are attended to before freezing weather begins, a large amount of shimming will be avoided during the winter.

DRAINAGE.

One of the most important factors in the maintenance of good track is drainage. The farther water is removed from roadbed and the sooner it is diverted therefrom the more efficient the track will become; every hour spent in perfecting drainage facilities and keeping them in good order lessens the amount of repair work required to keep the roadbed and track in proper condition. Ballast section should be kept trimmed to template so as to facilitate drainage therefrom and there should be no irregularities of the surface which can collect and retain water. Berm which has formed on embankments at the edge of the ballast section should be removed as it obstructs drainage of water from the ballast section. As the regular lining, surfacing, and cleaning up of track and right of way progresses, special attention must be given to drainage; all new ditches necessary must be made and all old ditches thoroughly cleaned out. During the Spring when snow is leaving the ground, all ditches and waterways must be cleaned out in such a manner as to permit the free and uninterrupted passage of surface water from the roadbed. The ditches shall

be generally parallel to the track except at inlets and outlets where they should diverge from the roadbed to prevent injury to embankments. Ditches, drains, culverts, and stream beds must at all times be kept free from ice or other obstructions that will in any way interfere with the free flow of water. The bottom of all ditches and side culverts must be maintained to even grade so as to avoid pockets and standing water.

Material removed in the cleaning out of ditches through cuttings must be used when possible to widen adjacent embankments and properly levelled off; such material should on no accounts be thrown on the face of cuts as ensuing rains will wash it back into the ditches again. The getting rid of water from roadbed at the earliest possible opportunity is of the utmost value in track maintenance. Cuts in which, owing to the character of the ground, efficient side ditches cannot be maintained, will be under-drained by means of tile pipe or other approved method.

No work on old or new drains or ditches for public or private use on the Railway Company's right of way must be permitted without proper authority.

It is important that when any drainage work or cut widening is being done, outlet ditches must be left unobstructed over night to avoid washouts from heavy rains. Should the general drainage of the ground be towards a cut or fill, surface ditches must be made outside the slopes and a sufficient berm provided between the slope and the ditch to check the flow of surface drainage.

Fills made of some clay materials may cause more or less trouble for a long time through more settlement under the ties than at the sides; this causes the water which drains through the ballast to be retained by the embankment. In cases where trouble of this kind is encountered, drainage may be improved by constructing a blind cross drain in the side of the fill. This consists of a trench dug from the ends of the ties and extending to the outer edge of the embankment, deep enough to extend to the bottom of the ballast under the track, and filled with loose stone or coarse gravel. Such trenches may be placed at intervals of about fifty feet and will overcome most of the disturbance caused by the seepage of water into and through the fills.

All places where trouble due to imperfect drainage is encountered should be carefully watched by the section foreman, and the Roadmaster should be advised with a view to deciding on the best plan for correcting the trouble.

MOWING AND WEEDING.

Weeds and grass on the track and right of way grow rapidly and considerable expenditure of labour is required to suppress their growth.

The weeding of ballast section should be done as often as may be necessary and carried out over the entire subdivision at the same time, so as to avoid a patchwork appearance; the work should be done systematically by beginning at one end of the section and continuing right through to the other end. If this work is followed in a definite manner each

section can be covered in a few days, leaving the men free to resume general repair work until such time as the weeds must again receive attention. The mowing of right of way should be carried out on the same lines.

CARE OF MATERIAL.

When any considerable quantity of rails and fastenings is being taken from the track and replaced by new material, all the old material, unless otherwise ordered, must be carefully collected and brought to headquarters, and not left lying on the track where it may be covered by ballast, or thrown to one side on the right of way where it cannot be found.

All employees should, at all times, bear in mind that no material is to be wasted. Scrap must be picked up and taken to section tool house at the close of each day. Old and new material must not be mixed, but must be carefully sorted and kept separately piled, or when stored, in separate compartments. Tools must be carefully collected after each day's work, and returned to the tool house. Economy must be practised in the use of all material as far as consistent with securing the best results. Many spikes are carelessly drawn; such spikes are often thrown in the scrap heap, where if a little more care were used or a moment given to straightening them they could be reused. Serviceable bolts, spikes, tie plates and fastenings of every description must be removed from old material before piling it. Old ties removed from the track each

day should be neatly piled for burning and all rubbish in the vicinity in which gangs are working which tends to accumulate on the right of way should be gathered up and properly disposed of.

SNOW AND ICE.

After a heavy snow storm the track should be shovel flanged at stations, water tanks, and other stopping places to prevent the snow from forming ice on the rails and causing engines to slip when starting trains. Switches should also be carefully cleared of snow, special attention being paid to thorough cleaning out of points and frogs.

The use of salt in connection with the clearing of switchwork during the winter months must be handled with proper judgment. Salt will not entirely remove snow or ice, and if used for that purpose will result in the formation of slush which will penetrate into the working parts of the frog and switchwork where it is liable to freeze solid and become a danger to trains as well as destructive to the switchwork. The proper purpose of salt at switchwork is to remove or prevent the formation of ice in the working parts at times of sudden change from thawing to freezing and must never be used when the temperature is uniformly low. Before salt is applied the switch and frog and their connections must all be cleared of snow and ice, and proper drainage channels cut so that any water formed by thaw, etc., will get a quick run-off.

At water tanks and standpipes in freezing weather the overflow of water will form ice to the top

of the rail and if this is not picked out and shovelled away each day, it will not only prevent engines from starting their trains, but may also cause derailments. Track has a natural tendency to heave at these places, and if this condition exists the roadbed should be dug out to a point below bottom of ballast section and filled in with coarse stone to within a few inches of the bottom of the ties. A light coat of ballast should then be placed on top of the stone to secure a uniform surface for the track.

WORK AROUND STATIONS AND IN YARDS.

A part of one day once a week should be devoted by the section force to cleaning up around stations, through yards and around section tool houses and section quarters. This is advisable for general sanitary reasons as well as for the sake of appearance. Cleanliness and neatness displayed in the care of station grounds give travellers a favourable impression of the Railway.

HANDLING OF DEFECTIVE GUARANTEED RAILS.

A guaranteed rail is a number one rail which has been in service for less than five years. As soon as possible after a defective guaranteed rail is discovered in the track it should be removed. It must then be painted on the web, in white paint, with the name of the Subdivision, mileage of point at which it was removed from track, and date of removal.

A cross should also be put on the rail close to, but not so close as to obscure the defect for which it was removed. If the rail is broken right through into two or more pieces, above information should be painted on each piece. The rail must then be taken to the nearest rail rack placed on the opposite side of track from the rail rack, and form M.W.S. 15½ sent in by the Section Foreman. The defective guaranteed rails must be held apart from other rails, until instructions are issued to load them up, when they will be shipped to the Division Headquarters, addressed to the General Storekeeper, against whom they should be charged at scrap rate, and they will be held by him until they are inspected by the Mills' and Company's Inspectors.

It is very important that all defective guaranteed rails be turned in to the General Storekeeper, as they will all be replaced with new No. 1 Rails; and rails not turned in are a loss to the Company.

HANDLING OF DEFECTIVE RAILS REMOVED FROM MAIN TRACK.

In order to avoid the possibility of defective rails that have been removed from main track being used again for main track repairs, after the defects for which they have been removed have got rusted over, (the rusting in a number of cases, will entirely obliterate the sign of defect), all defective rails moved from track must be placed on the opposite side of track from the rail racks and in two piles, defective guaranteed rails being kept separate from those which are not guaranteed. Rails must not be

placed on the rail racks or on the same side of the track as the rail racks, unless they are suitable for main track repairs.

When necessary, work train will be sent over the line to pick up defective rails and bring them to Roadmaster's headquarters or other approved point.

Form M.W.S. 15½ must be submitted to cover all defective rails removed from main track.

CLASSIFICATION OF RAILS.

NEW RAILS shall include:—
all rails not heretofore in service.

MAIN LINE RELAY RAILS shall include:—
Rails that are sound throughout, and which if curved can be straightened by rail bender when necessary.
The vertical wear on top of head not exceeding:—
For 80-85 lb. rail, one-eighth of an inch.
100 lb. rail, three-sixteenths of an inch.
Ends not down more than one-sixteenth of an inch in two feet or less.
Flange wear of head not exceeding one-sixteenth of original width.
Wear under head not greater than will leave at least one-eighth of an inch between angle bar and web of rail.
Rails not less than twenty-four feet long.

BRANCH LINE RELAY RAILS shall include:
Rails that are sound throughout and which

if curved can be straightened by rail bender when necessary.

The vertical wear of top of head not exceeding:—

For 56 lb. rail	one eighth of an inch.
" 60 to 85 lb.	one-quarter of an inch.
" 100 lbs.	three-eighths of an inch.

Ends not down more than three-sixteenths of an inch in two feet or less.

Flange wear of head not exceeding one-eighth of original width.

Wear under head not greater than will leave at least one-sixteenth of an inch between angle bar and web.

Rails not less than twenty feet long.

SIDING RAIL.

Rails that are unfit for main or branch lines, but which still have service left in them and shall include:—

Rails with badly battered ends.

Rails with broken flange that can be strengthened by angle bars.

Piped rails.

Rails not less than fifteen feet long.

SCRAP RAILS—to include:

Twisted and bent rails that cannot be straightened.

Rails from which the following lengths of serviceable rails cannot be cut.

80-85 100 lb.	11 ft.
72-75 lb.	14 ft.
65 lb. or less	6 ft.

Pieces of rail less than six feet long.

RAIL RACK RAILS.

Shall include all rails distributed on rail racks.

AUXILIARY AND EMERGENCY RAIL.

Shall include all rail loaded on auxiliary cars for emergency purposes.

NOTE.—Second hand rails or fastenings, except for main track repairs, must not be used without approval of Form M.W.S. 17.

RELAYING RAIL IN MAIN TRACK.

The life of rail in main track depends to a considerable extent on the care with which it is first laid, and the following instructions should therefore be carefully carried out.

Centre stakes will be set by the Engineer and track must be lined to stakes before old rail is released. Previous to releasing the old rail it must be classified, and each rail must be marked on the flange with white paint as follows:—"Main Line Relay", four spots; "Branch Line Relay", three spots; "Siding", two spots; "Scrap", one spot.

To secure correct gauge at least three lines of

spikes must be drawn, and in order to provide a uniformly true and level bearing for the new rail, tie-plates must be removed where necessary and ties adzed.

All spike holes must be plugged and spikes driven as nearly in the old locations as gauge will permit.

It is absolutely forbidden to drive a new rail into position with a hammer, maul or any similar tool, rails must be put in position with pinch or lining bars. Rails must be curved by rail bender when necessary, and standard track thermometer and expansion shims must be used while rail is being laid, in accordance with Maintenance of Way Rules.

All joints must be full bolted and all closures bored and bolted by rail laying gang before the close of each day's work. Split points used for closing track for passage of trains must not be left in track over night.

After new rail is laid, if work train on which to load old rails and angle bars is not immediately available, they must be picked up and piled conveniently for shipment with each quality of rail separate, and old bolts, spikes, chips, etc., carefully cleaned up and properly disposed of. This work should be closely followed by the placing of joint ties and the proper spacing of all other ties.

Tie-plates must be replaced under the rail as soon as jointing and tie spacing is complete. The best spikers available should be put on this work and particular attention paid to the placing of the tie plates so that their shoulders will have a full bearing along the base of the rail. The track gauge

must be continually in service so that new rail will be laid accurately to gauge.

Where both flat and canted tie plates are in use, they must not be mixed, but each kind laid in separate stretches to ensure a full bearing for the rail base.

All bolts must be gone over and retightened at short intervals until all are tight with angle bars home.

BALLASTING.

Before ballast operations commence, centre line and grade stakes will be given by the Engineer.

Through clay cuts ditches must be cleaned out ahead of the ballast train at proper distance from centre line and with bottom at least one foot below subgrade. In rock cuts ditches must be cleaned out with bottom at least six inches below subgrade, and all unsuitable ballast above the spawl filling removed.

Where old material between and around the ends of ties is suitable and roadbed of standard width, the track must first be thrown to line and then given a lift sufficient to use up the old ballast, ties renewed where necessary, all ties properly spaced and squared and the new ballast then distributed promptly so that the track will not remain in a weak condition.

Where old ballast above the bottom of ties is unsuitable it must be removed to the full width of the roadbed and used to widen embankments. The practice of mixing new ballast with old unsuitable

material from between and round the ends of ties is prohibited.

Care must be taken in distributing new ballast that surplus material is not deposited where it is not required and from where it will have to be lorried away later on.

Engineers and Roadmasters must exercise careful judgment in deciding amount of lift necessary so as to avoid waste of ballast where drainage conditions are good, and where additional ballast under the ties is unnecessary.

TILE DRAINAGE.

Tile drainage will be used through wet cuts where surface ditches are not sufficient to drain the roadbed.

Wherever subgrade will permit, tiling should be laid at least four feet below the surface of the ground and as close to the ends of the ties as possible without weakening the foundation of the track. Grade stakes will be furnished by the Engineer except where there is sufficient fall in track for top of rail to be used as a grade line for the tile pipe. The maximum grade practicable should be given to the pipe line so that quick discharge of drainage may be effected. In quicksand or where subgrade is very soft, tile pipe must be laid on boards.

The pipe must be laid with the bell end upgrade and must be covered over to a depth of about four inches with cedar bark, brush, straw or hay cut on the right of way. In heavy cuttings which have a

tendency to slide, trenches must be back-filled with coarse clean gravel; in other cases backfilling can be done with cinders.

On no account must any of the material excavated fro the trench be used as back-filling; it must all be moved out of the cut and used for bank widening or otherwise disposed of.

The outlets must be properly protected with rip-rap, and drainage at discharge should have a clear drop of at least six inches.

"SAFETY FIRST" APPLIED TO MAINTENANCE OF WAY EMPLOYEES.

Every Roadmaster and Foreman, whether a member of a Safety Committee or not, should consider it his duty to give attention to all matters, pertaining to the safety of the men employed under him. Many dangerous methods are in use by trackmen in performing track construction, repair work, and in handling tools; and foremen should be always on the lookout for these methods and by advice and example, endeavour to correct them. Lack of system and bad practice are responsible for many injuries.

Talking when performing dangerous work should be stopped as much as possible.

When handling rails there should be a competent man at each end of the rail with the rest of the gang paying attention to these men. Tongs should be used when carrying rails.

Rail chisels should be kept in good repair and those with badly battered or split heads not used

as pieces are liable to fly off. Spike mauls should not be used for striking chisels. When cutting rails the practice of lifting the rail as high as the men can reach and allowing it to drop should not be permitted. The use of a rail bender is the proper method of breaking the rail after cutting.

Holding a spike maul on the head of a spike and striking it with another maul, is dangerous, and must not be permitted as the steel is brittle and liable to break, and when pulling spikes the claw bar should not be driven under the spike head by striking it with a maul, as the spike head or pieces of the bar are liable to fly off.

Track jacks should be handled with care to avoid accidental tripping and the most competent men in the gang should be assigned to this work.

Jumping on and off moving cars and trains, crawling under cars, climbing over cars in yards, passing between cars standing close together, taking shelter from rain under cars, sitting under cars to eat lunch, getting on and off hand and push cars in motion, running hand and push cars or motor cars over interlocked switches without a clear understanding with the tower man, applying brakes on hand and motor cars without warning to the men on the car, allowing the men to leave track tools on or near track, leaving planks with nails projecting from them, standing, walking or working on tracks while trains are passing on adjacent tracks, riding on or standing close to a plough when unloading ballast or other material, standing near cables when ploughing off cars, sitting on brake wheels of cars at any time, running hand cars and motor cars at

a high rate of speed and too close together and standing close to track when trains are passing, are some of the many acts of carelessness on the part of employees which result in accidents and injury, and to which special attention should be given.

C.P.R.
STANDARD BOLTS

Approved:

Montreal, 26th June 1913.

Ass't Chief Engineer
Eastern Lines.

Chief Engineer.
Western Lines.

ORDER BOLTS BY THESE NUMBERS	LENGTH AND SCREW DIA.	BODY DIA.	LENGTH OF SCREW	NUT	MARK AND SIZE OF SPECIAL NECK
#1	4 3/4" × 1"	15/16"	2 1/2"	Sq.	U 
#2	4 3/8" × 7/8"	13/16"	2 1/4"	Sq.	W 
#2A	4 1/8" × 7/8"	13/16"	2 1/4"	Sq.	
#3A	3 3/4" × 7/8"	13/16"	2 1/8"	Hex.	
#3B	3 1/2" × 7/8"	13/16"	2 1/8"	Hex.	
#3C	3 1/4" × 7/8"	13/16"	2"	Hex.	
#4	4" × 13/16"	3/4"	2 1/8"	Hex.	X 
#4A	3 3/4" × 13/16"	3/4"	2 1/8"	Hex.	
#4B	3 1/2" × 13/16"	3/4"	2 1/8"	Hex.	
#4C	3 1/4" × 13/16"	3/4"	1 3/4"	Hex.	

NOTES.

Roadbed to be ballasted with Clean Gravel and Engine Cinders.
Put the Coarse Gravel and Boulders on the outer slopes at the end of the ties

C. P. R.

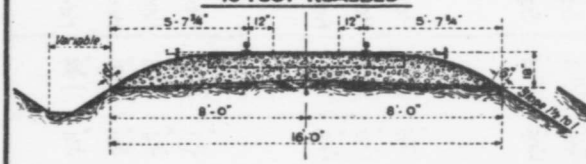
BALLAST SECTIONS

GRAVEL

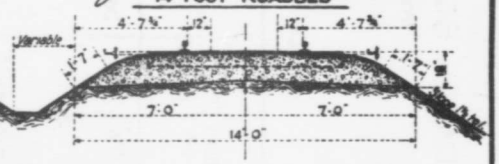
Montreal 5th March 1913.

Approved [signature] Chief Engineer W.L. Approved [signature] Asst. Chief Engineer E.L.

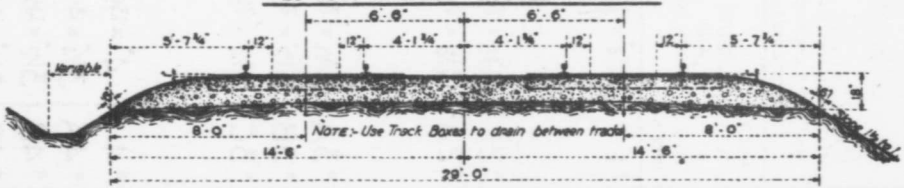
16 FOOT ROADBED



14 FOOT ROADBED



29 FOOT ROADBED - DOUBLE TRACK.



NOTES.

The sixteen (16) foot Ballast Sections will be used also for roadbeds eighteen (18) and twenty (20) feet wide.
The Elevation of the Outer Rail on curves will be secured by increasing the amount of Ballast and widening the Roadbed instead of inclining the surface of the Roadbed
There must be Berms not less than Four (4) Feet

C. P. R.

BALLAST SECTIONS

29'-0"

NOTES.

The sixteen (16) foot Ballast Sections will be used also for roadbeds eighteen (18) and twenty (20) feet wide.
The Elevation of the Outer Rail on curves will be secured by increasing the amount of Ballast and widening the Roadbed instead of inclining the surface of the Roadbed.
There must be Berms not less than Four (4) feet wide between the slopes of the embankments and borrow pits and the slopes of these pits or ditches must be at least one and one half (1½) to one (1).
When Special Ditches are required the variable dimension is to be Fixed by the Engineer.

C. P. R.
BALLAST SECTIONS

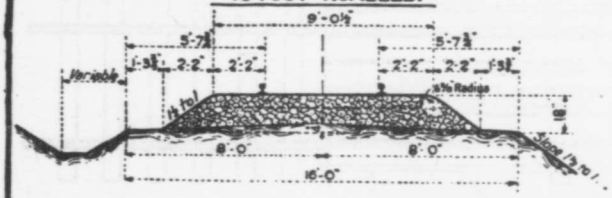
BROKEN STONE

Montreal 5th March 1913.

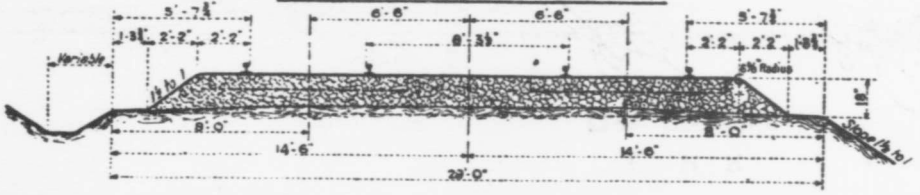
Approved [signature] Chief Engineer W.D.

Approved [signature] Ass't Chief Engineer E.L.

16 FOOT ROADBED.



29 FOOT ROADBED - DOUBLE TRACK.

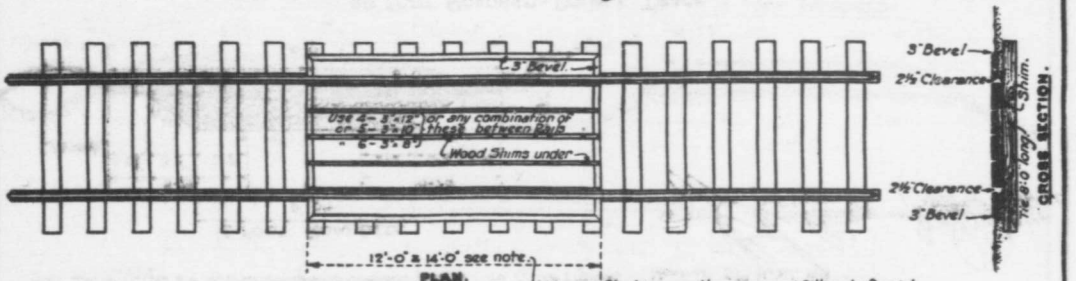


C. P. R.

FARM CROSSING

Montreal 5th March 1913.

Approved [signature] Chief Engineer W.L. Approved [signature] Asst. Chief Engineer E.L.



NOTE:- Planking or other approved filling to furnish a road surface of not less than 14 feet wide in the Provinces of Manitoba, Saskatchewan, Alberta, & British Columbia, 12 feet wide in the other Provinces of the Dominion.

194

The section of Rail of the Main Line, or the Switchwork shall extend continuously on the side track as far as point "A".

C · P · R

The section of Rail of the Main Line, or the Switchwork shall extend continuously on the side track as far as point "A".

From "A" to "B". (the end of the turnout curve) second-hand relaying steel of 73# or heavier section shall be used.

Equip both curves with Tie Plates which shall be at least double spiked on the outside, and see that the ties are in good condition.

C · P · R

RAIL DISTRIBUTION

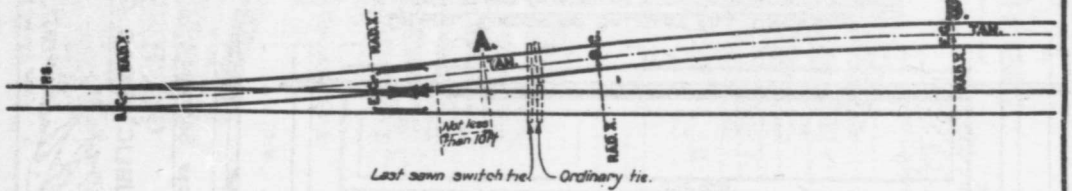
FOR

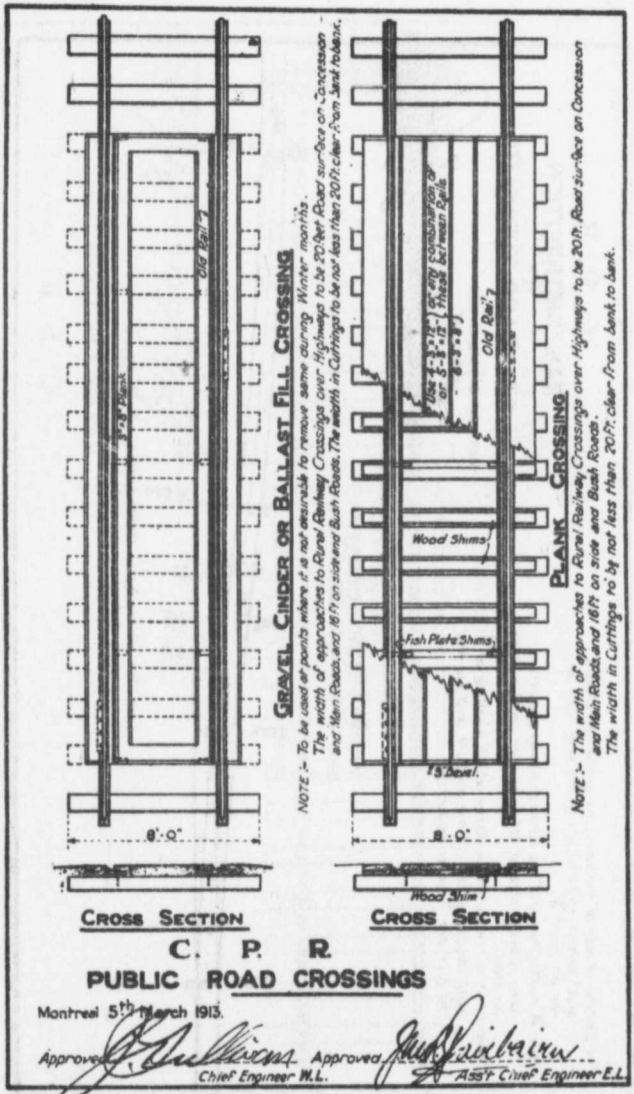
STANDARD TURNOUTS

Montreal 5th March 1913

Approved: [signature] Chief Engineer W.L.

Approved: [signature] Asst. Chief Engineer E.L.





GRAVEL CINDER OR BALLAST FILL CROSSING

NOTE:- To be used at points where it is not desirable to remove same during Winter months.
The width of approaches to Rural Railway Crossings over Highways to be 20 Feet Road surface on Concession and Main Roads, and 16 Ft on side and Bush Roads. The width in Cuttings to be not less than 20 Ft: clear from Bank to Bank.

PLANK CROSSING

NOTE:- The width of approaches to Rural Railway Crossings over Highways to be 20 Ft. Road surface on Concession and Main Roads, and 16 Ft on side and Bush Roads.
The width in Cuttings to be not less than 20 Ft: clear from bank to bank.

C. P. R.

PUBLIC ROAD CROSSINGS

Montreal 5th March 1913.

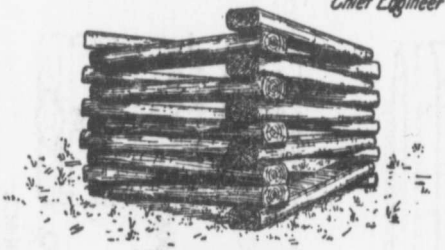
Approved J. Hobbs Williams Chief Engineer W.L.

Approved [illegible] Ass't Chief Engineer E.L.

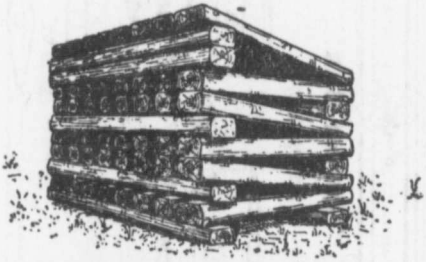
C. P. R.
TIE PILING

Montreal 2nd October 1905

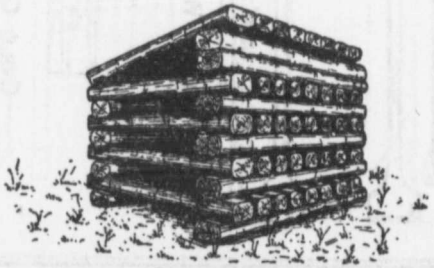
W. H. Sayre
Chief Engineer



TRIANGULAR PILE



DOUBLE LAYER SQUARE PILE



SQUARE PILE

and main roads and left on site and Bush Roads.
The width in Cuttings to be not less than 20 Ft. clear from bank to bank.

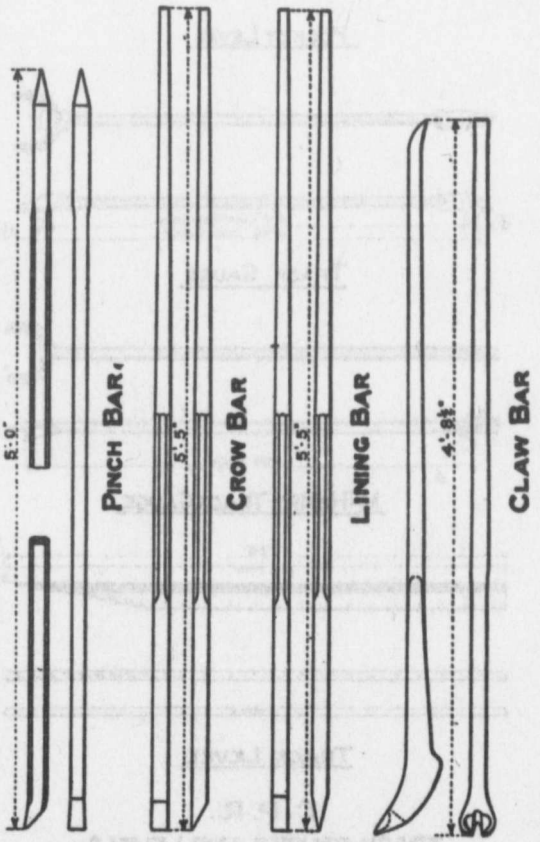
C. P. R.
TRACK TOOLS

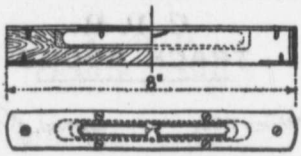
Montreal, 19th March, 1906. Approved _____
Asst. Chief Engineer.

C. P. R.
TRACK TOOLS

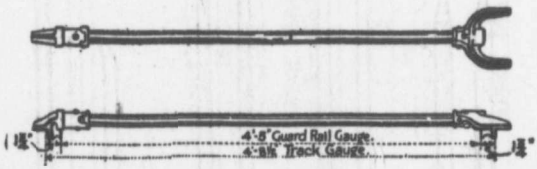
Montreal, 16th March 1906,

Approved. [signature]
Asst. Chief Engineer

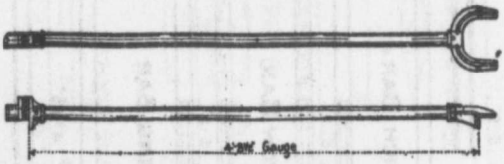




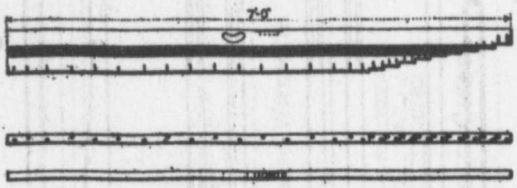
POCKET LEVEL



TRACK GAUGE



McHENRY TRACK GAUGE



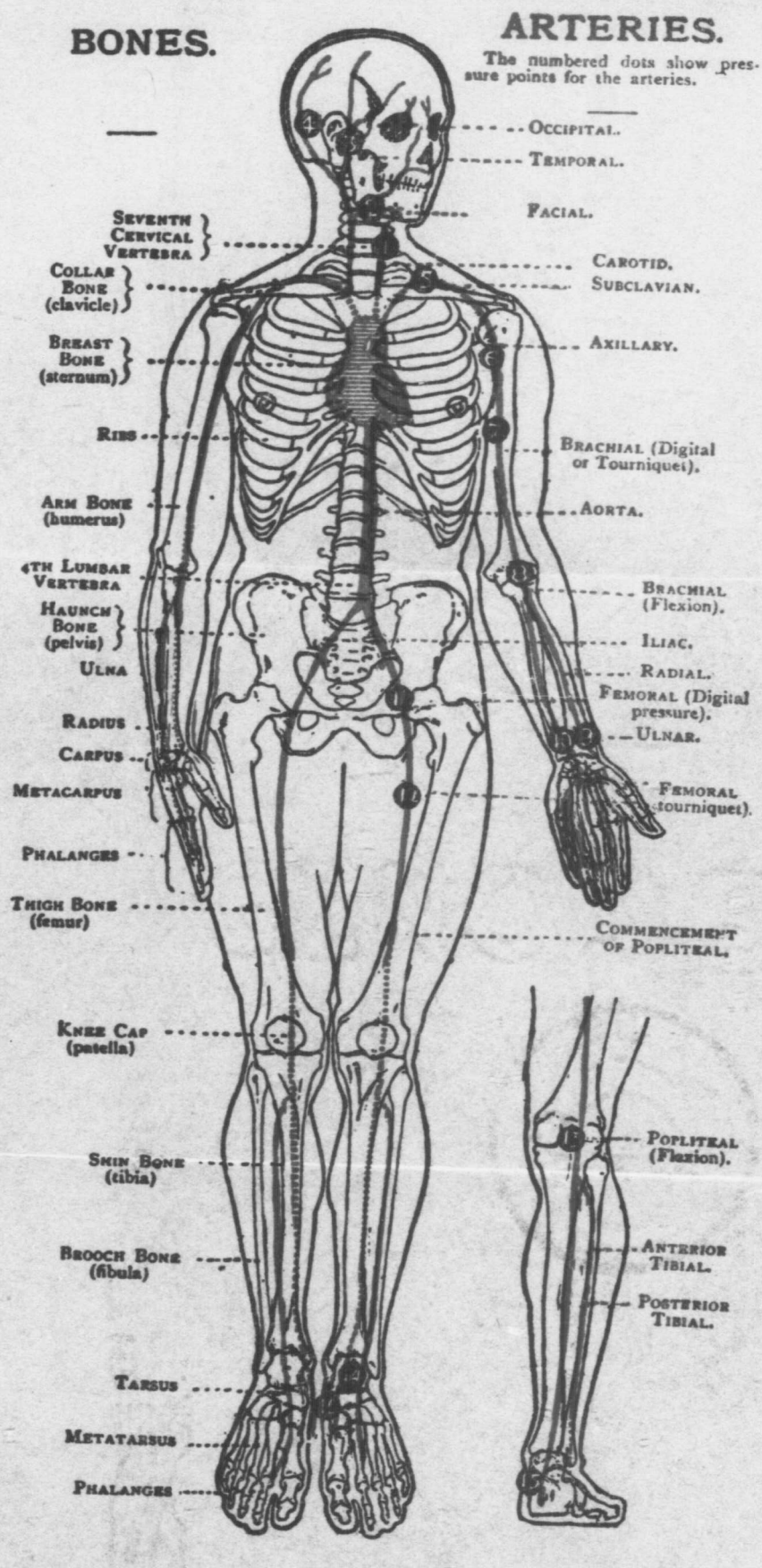
TRACK LEVEL

C. P. R.

TRACK GAUGES AND LEVELS

Montreal: 16th February 1906

Approved: [signature]
Asst: Chief Engineer


BONES.
ARTERIES.
The numbered dots show pressure points for the arteries.
Occipital.
Temporal.
Facial.
Seventh Cervical Vertebra
Carotid.
Collar Bone (clavicle)
Subclavian.
Breast Bone (sternum)
Axillary.
Ribs
Brachial (Digital or Tourniquet).
Arm Bone (humerus)
Aorta.
4th Lumbar Vertebra
Brachial (Flexion).
Haunch Bone (pelvis)
Iliac.
Ulna
Radial.
Femoral (Digital pressure).
Radius
Ulnar.
Carpus
Femoral (tourniquet).
Metacarpus
Phalanges
Thigh Bone (femur)
Commencement of Popliteal.
Knee Cap (patella)
Popliteal (Flexion).
Shin Bone (tibia)
Anterior Tibial.
Brooch Bone (fibula)
Posterior Tibial.
Tarsus
Metatarsus
Phalanges