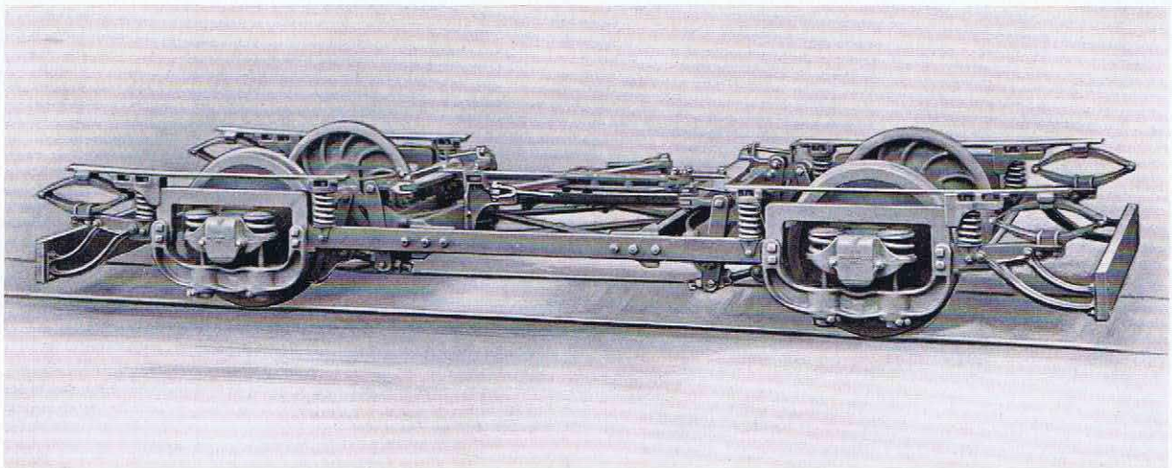


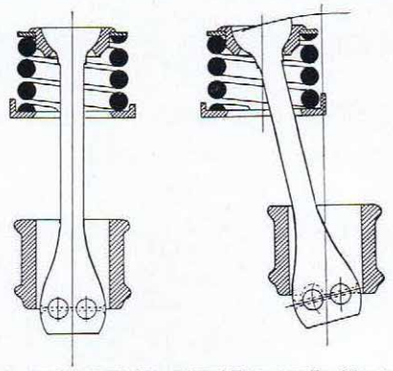
BRILL "RADIAX" TRUCK

THE most important of the distinguishing features of this truck are the solid forged side frames and the form of swing link used. It is plain that the long wheel base, long overhang, and the extra load per wheel demand the strongest construction possible. The Brill solid forging process gives to the "Radiax" truck this fundamental factor of strength and simplicity of construction.

It was long ago proved that the radial-axle truck must have links to suspend the load below the axles. But the swing link has a grave defect in that on straight track it transmits to the car body every irregularity of the track with multiplied effect, and this is particularly noticeable in cars having a wheel base shorter than 11 feet, as the king pins are necessarily close together, giving the whole construction a very small amount of lateral stability. Therefore the ordinary swing link radial-axle truck is generally found to oscillate horizontally, causing a snake-like motion. Until a means was found of obtaining free radiation, coupled with the return of the axles to their normal position on leaving a curve and at the same time holding the car body in a direct line on straight track, the radial-axle truck was doomed to failure.

How the swing link is made to perform its functions in a manner which gives both free radiation to the axles and stability and easy riding to the car body, is found in the patented device of The J. G. Brill Company, which consists of pairs of swing links of special form, mounted on spiral springs which rest in ears cast on each side of the journal boxes. The upper end of the links is of hemispherical form and rests in a socket casting at the top of the spring. The link passes through the spring and at its lower end has two pins, or trunnions, which engage in grooves formed in a casting enclosing the lower part of the frame yoke. On straight track with the link in upright position the frame rests on both pins. When a movement of the swing link commences, owing to a bad irregularity of the track being encountered, at that instant one or other of the pins comes out of engagement with its groove, even though the movement is imperceptible, thereby producing an inclination between the two supporting points of the link equal to half the distance between the pins, which sets up an immediate and powerful tendency to return to normal position. If the link was pivoted on a single pin at the lower end, the swing

would require to be considerably more, or half the distance between the two pins of the Brill device, to produce an equal force to assist in returning the axle to its normal position. As the pin returns to its groove, any tendency of the link to swing past its normal position is instantly checked by the sudden force in the opposite direction generated as the other pin leaves its groove. It will therefore be seen that the double-pin arrangement has a twofold office — one to assist in holding the link in an upright position against the effect of irregularities of the track, and the other to assist the link in its tendency to draw the axle back to its normal position when leaving a curve, or when the normal position of the axle is disturbed momentarily owing to track irregularities.

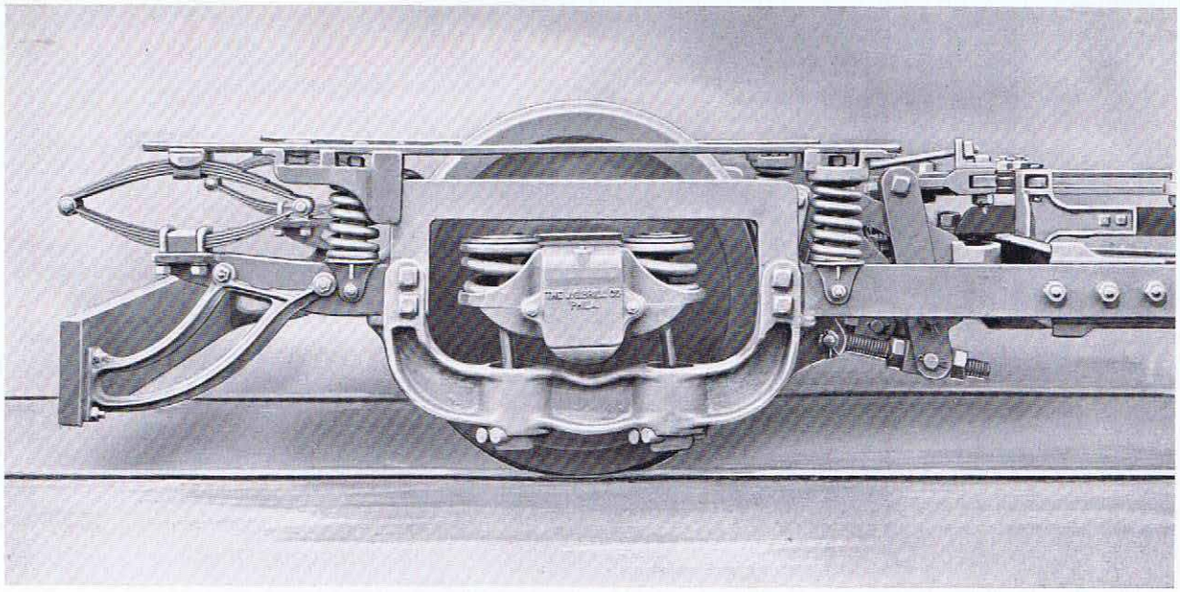


Swing Link in Normal and Extreme Positions

The double-pin device does not hinder the primary function of the links, of allowing the axles to radiate freely on curves. The links are much longer than in any other truck of this class and permit a considerable radial movement of the axles to take place without requiring the links to assume an excessive inclination, the resistance generated by their inclination being overcome by the centrifugal force stored in the car. If the car is stopped on a curve the axles will return gradually toward but never quite resume their normal position, but will rapidly increase their angle of radiation as the car is started again. It should be remembered that a radial truck can safely negotiate curves at a much higher speed than a rigid wheelbase truck, and that the faster a curve is traversed the easier a truck will radiate and the less will be the flange wear.

An important feature of the Brill "Radiax" truck is the use of the motor as the only means of connecting the axle to the king bolt, which is the pivotal point; the motor bearing being rigidly connected to the cross member which carries the brake rigging causes the axle, motor and brakes to radiate as a whole from the king bolt and form a complete unit corresponding to a single axle pivotal truck. In old styles of radial-axle truck construction it was usual to construct a complete pivotal frame, usually called a subtruck, which frame connected the journal boxes with the king bolt and supported the brake rigging and the motor. It is difficult to obtain a rigid construction in such a frame and at the same time allow room for the motor, and, of course, this adds very considerably to the weight of the truck. There is no objection to pivoting to the motor, as the most exhaustive tests have proved that no undue wear on the bearings results, and the ordinary construction of motor frames is amply strong to offset any risk of failure. Careful measurements taken from motors in service have shown that the motor bearings wear less in a horizontal direction due to the brake thrust than in a vertical direction due to the weight of the motor, and that the life of the motor bearings is limited by vertical wear and not by a horizontal wear, which would allow the gears and pinions to get out of pitch with each other.

The brake gear has been a constant source of trouble on most designs of radial axle trucks. In the Brill "Radiax" truck the brakes are fitted with inside hung shoes, the advantages of which are well known; the brake rigging is arranged with the pivotal points directly over the king bolts, giving the same radial action to the brake beam as to the wheels



Near view of end of "Radiax" Truck with axle out of parallel. Full elliptic spring shown is special for short cars

and providing an equal pressure on the whole surface of all four brake shoes against the wheel treads. The other brake details have been completely developed, and experience has proved them to be entirely reliable under all conditions.

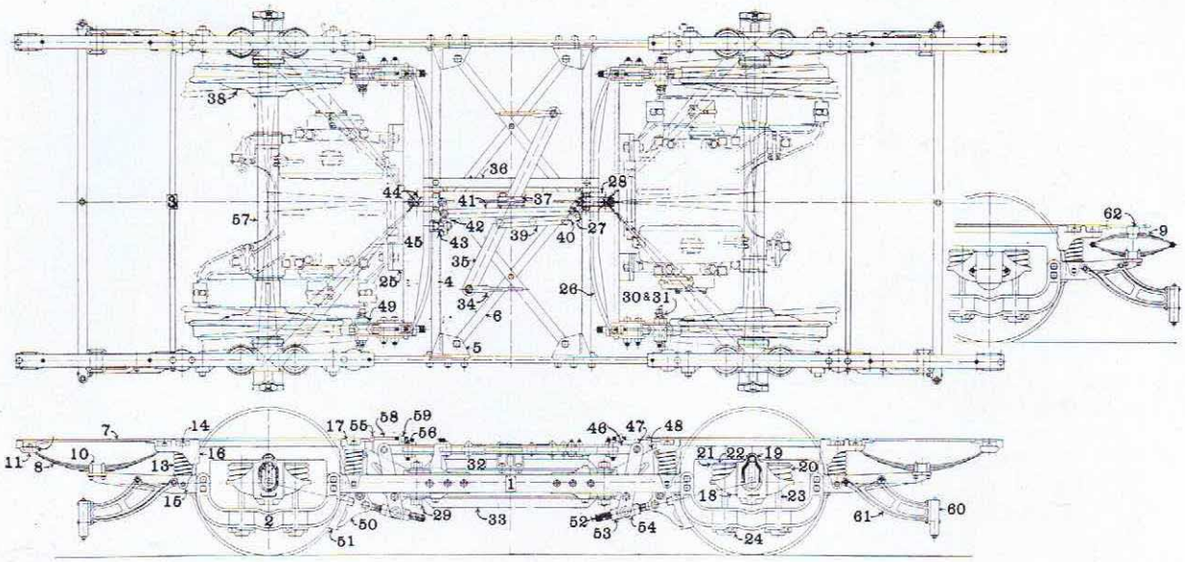
The patented "Half Ball" Brake Hanger is used as in all Brill trucks and is self-adjusting for wear, and therefore noiseless.

The spring arrangement is the same in principle as that which has proved so efficient in the Brill standard rigid axle single truck No. 21-E.

The radial-axle truck, by providing a long wheel base to the car body, reduces the overhang and therefore eliminates galloping motion, uncomfortable to passengers and destructive to the car and roadbed; it reduces the side overhang on curves, and by furnishing a more extended support permits a lighter construction of the car body; it secures the full tractive force of the wheels, not obtainable in the two-motor equipment of an eight-wheel car.

This truck is intended for cars longer than suitable for mounting on rigid wheel-base types and of lengths up to 26 feet over the body corner posts. It has been designed to interchange with any type of rigid axle truck with slight modifications of the car bottom framing and motor trap location where the car body is of a length which would make it desirable to use the radial axle principle, and the "Radiax" E-1 truck is built to carry a car at the same height above the track as the Brill No. 21-E truck.

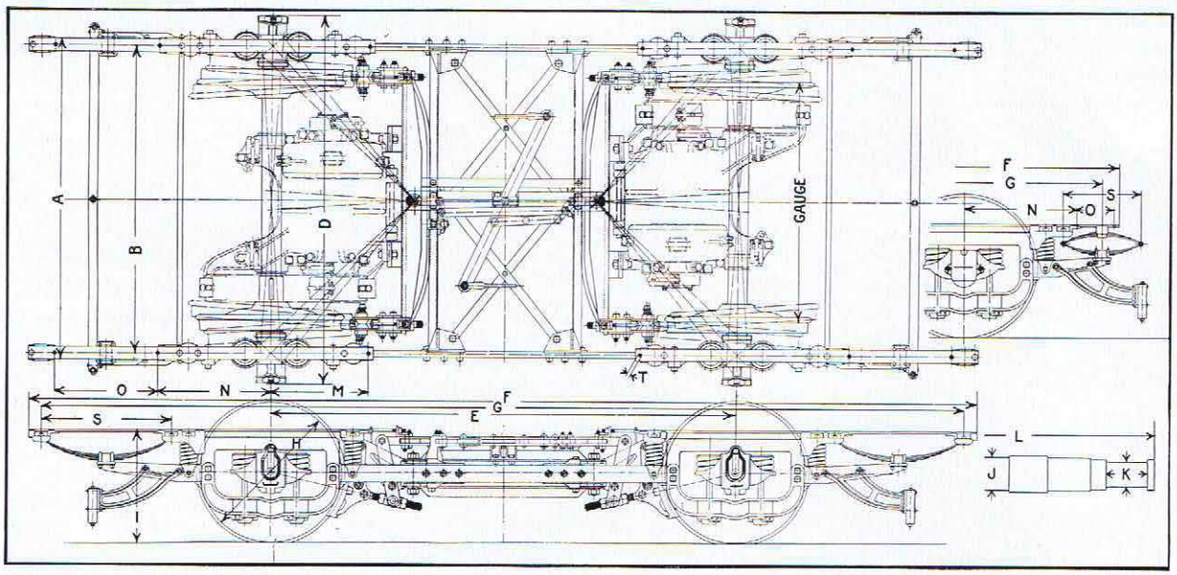
NAMES OF PARTS OF
BRILL "RADIAX" TRUCK



1. Side Frame
2. Yoke Brace
3. End Frame Pipe and Tie Rod
4. Cross Bar
5. Cross Bar Corner Bracket
6. Cross Bar Brace
7. Top Chord
8. Body End Spring (semi-elliptic)
9. Body End Spring (full elliptic)
10. Body End Spring U-bolt
11. Body End Spring Cap (half-elliptic)
12. Body End Spring Wear Plate
13. Body Spring (coil)
14. Body Spring Bolt
15. Body Spring Seat
16. Thrust Piece
17. Body Spring Cap
18. Journal Box
19. Journal Box Lid
20. Journal Box Spring
21. Journal Box Spring Cap
22. Swing Link Socket
23. Swing Link
24. Swing Link Pin
25. Motor Suspension Bracket
26. Motor Suspension Casting
27. Cross Bar Brace Casting
28. King Bolt Reinforcing Plate
29. King Bolt
30. Brake Hanger Spring Top
31. Brake Hanger Spring Bottom
32. King Bolt Support (Top)
33. King Bolt Support (Bottom)
34. Brake Rod
35. Center Lever
36. Center Lever Slide
37. Center Lever Fulcrum
38. Wheel
39. Center Lever Connection
40. Live Lever
41. Lever Connection
42. Dead Lever
43. Dead Lever Fulcrum
44. Top Truck Connection
45. Equalizing Beam
46. Clevis
47. Upright Lever
48. Brake Hanger Carrier
49. Brake Hanger, "Half-Ball"
50. Brake Head
51. Brake Shoe
52. Bottom Truck Connection
53. Bottom Truck Connection Jam Nut
54. Bottom Truck Connection Trunnion
55. Release Spring
56. Release Spring Bracket
57. Axle
58. Release Spring Hook Bolt
59. Release Spring Hook Bolt Nut
60. Wheelguard
61. Wheelguard Bracket
62. Body End Spring Cap (full elliptic)

BRILL "RADIAX" TRUCK

Patented and patents pending in the United States and Foreign Countries



Dimensions of Brill "Radiax" E 1 Truck

For Wheels up to 2½" Width of Tread		Gauge	3′0″	3′3⅜″	3′6″	4′0″	4′8½″*	5′0″	5′2½″	5′3″
	A	Width over Top Plates	4′11″	5′2⅜″	5′5″	5′11″	6′3″*	6′6½″	6′9″	6′9½″
	B	Centers of Top Plates	4′8″	4′11⅜″	5′2″	5′8″	6′0″*	6′3½″	6′6″	6′6½″
	L	Length of Axle	5′4¼″	5′7⅝″	5′10¼″	6′4¾″	6′8¼″*	6′11¾″	7′2¼″	7′2¾″
	D	Width over All—Standard	5′11″	6′2⅜″	6′5″	6′11″	7′3″*	7′6½″	7′9″	7′9½″
		Width over All—Restricted	5′6″	5′9⅜″	6′0″	6′6″	6′10″*	7′1½″	7′4″	7′4½″
For Wheels over 2½" Width of Tread	A	Width over Top Plates	4′11″	5′2⅜″	5′5″	5′11″	6′6″	6′9½″	7′0″	7′0½″
	B	Centers of Top Plates	4′8″	4′11⅜″	5′2″	5′8″	6′3″	6′6½″	6′9″	6′9½″
	L	Length of Axle	5′4¼″	5′7⅝″	5′10¼″	6′4¾″	6′11¾″	7′2¾″	7′5¼″	7′5¾″
	D	Width over All—Standard	5′11″	6′2⅜″	6′5″	6′11″	7′6″	7′9½″	8′0″	8′0½″
		Width over All—Restricted	5′6″	5′9⅜″	6′0″	6′6″	7′1″	7′4½″	7′7″	7′7½″

H	Diameter of Wheel	30″	33″	34″
I	Height of Truck—With Weight of Empty Car Body	25⅛″	26⅝″	27⅛″

M	Location of Body Bolt Hole	1′10½″
N	Location of Body Bolt Hole	2′2⅛″
T	Diameter of Body Bolts	¾″

Full Elliptic Spring S=18"	E	Wheel Base	8′0″	8′6″	9′0″	9′6″	10′0″	10′6″	11′0″	11′6″	12′0″
	F	Length over Top Plates	14′0″	14′6″	15′0″	15′6″	16′0″	16′6″	17′0″	17′6″	18′0″
	G	Spring Base	13′4″	13′10″	14′4″	14′10″	15′4″	15′10″	16′4″	16′10″	17′4″
	O	Location of Body Bolt Hole	8⅝″	8⅝″	8⅝″	8⅝″	8⅝″	8⅝″	8⅝″	8⅝″	8⅝″
Semi-Elliptic Spring S=24"	F	Length over Top Plates	16′4″	16′10″	17′4″	17′10″	18′4″	18′10″	19′4″	19′10″	20′4″
	G	Spring Base	15′10″	16′4″	16′10″	17′4″	17′10″	18′4″	18′10″	19′4″	19′10″
	O	Location of Body Bolt Hole	1′5¾″	1′5¾″	1′5¾″	1′5¾″	1′5¾″	1′5¾″	1′5¾″	1′5¾″	1′5¾″
Semi-Elliptic Spring S=30"	F	Length over All	17′4″	17′10″	18′4″	18′10″	19′4″	19′10″	20′4″	20′10″	21′4″
	G	Spring Base	16′10″	17′4″	17′10″	18′4″	18′10″	19′4″	19′10″	20′4″	20′10″
	O	Location of Body Bolt Hole	1′11¾″	1′11¾″	1′11¾″	1′11¾″	1′11¾″	1′11¾″	1′11¾″	1′11¾″	1′11¾″
Semi-Elliptic Spring S=36"	F	Length over All	18′4″	18′10″	19′4″	19′10″	20′4″	20′10″	21′4″	21′10″	22′4″
	G	Spring Base	17′10″	18′4″	18′10″	19′4″	19′10″	20′4″	20′10″	21′4″	21′10″
	O	Location of Body Bolt Hole	2′5¾″	2′5¾″	2 5¾″	2′5¾″	2′5¾″	2′5¾″	2′5¾″	2′5¾″	2′5¾″

Minimum Curve Radius to Suit Wheel Base

Wheel Base for Radiax Trucks		8′0″	8′6″	9′0″	9′6″	10′0″	10′6″	11′0″	11′6″	12′0″
American Elec. Ry. Assoc. Flange	A	25′6″	27′1″	28′8″	30′3″	31′10″	33′5″	35′0″	36′7″	38′2″
1¾″ Wide Rail Groove	B	4′7¼″	4′10¾″	5′2¼″	5′5⅝″	5′9″	6′0½″	6′4″	6′7½″	6′11″
British Standard Flange and Rail Groove 1¼″ Wide	A	29′0″	30′10″	32′8″	34′6″	36′4″	38′2″	40′0″	41′10″	43′8″
	B	4′1½″	4′4⅜″	4′7¾″	4′10¾″	5′1⅜″	5′5″	5′8″	5′11⅛″	6′2¼″

A—The Minimum Curve Radius to suit the various wheel bases given under the conditions stated in left hand column.
B—The minimum Radius for the various wheel bases for British Conditions, 10′0″ Wheel Base Radiax Truck can be used for curves as sharp as 36′4″ radius measured to center of track and will pass around the curve as easily as a 5′11″ wheel base rigid axle truck would do. The position of the wheel flange in the rail groove being the same for the 10′0″ wheel base Radiax or the 5′11″ wheel base rigid axle truck.

The Following Limitations are Recommended

Maximum Journal M. C. B. (Check Plate Journal not Recommended)	3¾″x7″
Weight of Car Body with Equipment and Passenger Load—Not to Exceed	24,000 Lbs.
Speed—Not to Exceed	30 M. P. H.
Motors—Not to Exceed	60 H. P.

* See next page for Special Trucks.

Dimensions of Brill "Radiax" E 1 Special Truck

Radiax E1. M—Special

To Suit Two-Metre Overall Limitation for Standard Gauge Track

	A	B	L	D
Gauge	Width over Top Plates	Centers of Top Plates	Length of Axle	Width over All
4′8½″	6′2″	5′11″	6′5⅞″	6′6¼″

All other truck dimensions are the same as for Standard Radiax E1 Trucks.

Radiax E1. B—Special

To Suit British and Similar Limitations of Height, Width, Rail Groove, and Flange under Cars which are Longer and Heavier than can be Carried on Standard Radiax E1 Truck

	A	B	L	D
Gauge	Width over Top Plates	Centers of Top Plates	Length of Axle	Width over All
4′8½	6′4″*	6′1″	6′9¼″	6′10½″

For Gauges 4′0″ or less above dimensions will be same as for Standard Radiax E1 Trucks.
For Gauges over 4′8½″ add difference in track gauge to above dimensions.
*For cars less than 6′4″ outside of sills a special design of top plate will be furnished, which avoids change of dimensions L and D, or of side frame centers (6′1″). Blue Print of Car Underframe should be sent with order.

H	Diameter of Wheel	30″	33″	34″
I	Height of Truck—With Weight of Empty Car Body	26½″	28″	28½″

Dimensions E, F, G, M, N, O, S, and T, are same as for Standard Radiax E1 Trucks.

The Following Limitations are Recommended

	E1—(M-Special)	E1—(B-Special)
Maximum Journal M. C. B. Style—Check Plate Journal not Recommended	4′x6″	4′x7″
Weight of Car Body with Equipment and Passenger Load—Not to Exceed	30,000 Lbs.	30,000 Lbs.
Speed—Not to Exceed	30 M. P. H.	30 M. P. H
Motors—Not to Exceed	60 H. P	60 H. P

Minimum Curve Radius to Suit Wheel Base

Wheel Base for Radiax Trucks		8′0″	8′6″	9′0″	9′6″	10′0″	10′6″	11′0″	11′6″	12′0″
Radiax E1 (M Special) . . . . . Subject to Change to Suit Varying Flange and Rail Groove Conditions	A	32′0″	34′0″	36′0″	38′0″	40′0″	42′0″	44′0″	46′0″	48′0″
	B	4′8½″	5′0″	5′3½″	5′7″	5′10½″	6′2⅛″	6′5⅝″	6′9¼″	7′0¾″
Radiax E1 (B Special) . . . . . To Suit British Standard Flange and Rail Groove 1¼″ Wide	A			30′0″	31′8″	33′4″	35′0″	36′8″	38′4″	40′0″
	B			4′7⅜″	4′10⅛″	5′1¼″	5′4¼″	5′7⅜″	5′10⅜″	6′1½″

A—The Minimum Curve Radius to suit the various wheel bases given under the conditions stated in left hand columns.
B—The Minimum Curve Radius to suit Wheel Base of Truck can be used for curves as sharp as 36′4″ radius measured to center of track and will pass round the curve as easily as a 5′11″ wheel base rigid axle truck would do. The position of the wheel flange in the rail groove being the same for the 16′0″ wheel base Radiax or the 5′11″ wheel base rigid axle truck.

Dimensions of Brill "Radiax" E 2 Truck

For Wheels up to 2½″ Width of Tread		Gauge	3′0″	3′3⅜″	3′6″	4′0″	4′8½″	5′0″	5′2½″	5′3″
	A	Width over Top Plates	4′11″	5′2⅜″	5′5″	5′11″	6′6″	6′9½″	7′0″	7′0½″
	B	Centers of Top Plates	4′8″	4′11⅜″	5′2″	5′8″	6′3″	6′6½″	6′9″	6′9½″
	L	Length of Axle	5′5¼″	5′8⅝″	5′11¼″	6′5¼″	7′0¼″	7′3¾″	7′6¼″	7′6¾″
	D	Width over All—Standard	5′11½″	6′2⅞″	6′5½″	6′11½″	7′6½″	7′10″	8′0½″	8′1″
		Width over All—Restricted*	5′7″	5′10⅜″	6′1″	6′7″	7′2″	7′5½″	7′8″	7′8½″
For Wheels over 2½″ Width of Tread	A	Width over Top Plates	5′1⅝″	5′5″	5′7½″	6′1½″	6′8½″	7′0″	7′2½″	7′3″
	B	Centers of Top Plates	4′10⅝″	5′2″	5′4½″	5′10½″	6′5½″	6′9″	6′11½″	7′0″
	L	Length of Axle	5′7⅞″	5′11¼″	6′1¾″	6′7¾″	7′2¾″	7′6¼″	7′8¾″	7′9¼″
	D	Width over All—Standard	6′2⅛″	6′5½″	6′8″	7′2″	7′9″	8′0½″	8′3″	8′3½″
		Width over All—Restricted*	5′9⅝″	6′1″	6′3½″	6′9½″	7′4½″	7′8″	7′10½″	7′11″

H	Diameter of Wheel	30″	33″	34″
I	Height of Truck—With Weight of Empty Car Body	2′5⅝″	2′7⅛″	2′7⅜″

M	Location of Body Bolt Hole	2′0¾″
N	Location of Body Bolt Hole	2′4¾″
T	Diameter of Body Bolts	¾″

S=30″	F	Wheel Base	10′0″	10′6″	11′0″	11′6″	12′0″	12′6″	13′0″
	F	Length over All	19′8½″	20′2½″	20′8½″	21′2½″	21′8½″	22′2½″	22′8½″
	G	Spring Base	19′2½″	19′8½″	20′2½″	20′8½″	21′2½″	21′8½″	22′2½″
	O	Location of Body Bolt Hole	1′11¾″	1′11¾″	1′11¾″	1′11¾″	1′11¾″	1′11¾″	1′11¾″
S=36″	F	Length over All	20′8½″	21′2½″	21′8½″	22′2½″	22′8½″	23′2½″	23′8½″
	G	Spring Base	20′2½″	20′8½″	21′2½″	21′8½″	22′2½″	22′8½″	23′2½″
	O	Location of Body Bolt Hole	2′5¾″	2′5¾″	2′5¾″	2′5¾″	2′5¾″	2′5¾″	2′5¾″

The Following Limitations are Recommended

Maximum Journal M. C. B. (Check Plate Journal not Recommended)	4¼″x8″
Weight of Car Body with Equipment and Passenger Load—Not to Exceed	36,000 Lbs.
Speed—Not to Exceed	30 M. P. H.
Motors—Not to Exceed	75 H. P.

*This dimension may be further reduced if desired by an amount depending on shape of wheel flange and rail groove, wheel base desired, curve radius, etc. Dimensions A, B, and L would be subject to change also.

Minimum Curve Radius to Suit Wheel Base with American Electric Railway Association Flange and Rail Groove 1¾″ Wide

Wheel Base of Radiax E2 Truck	10′0″	10′6″	11′0″	11′6″	12′0″	12′6″	13′0″
Minimum Curve Radius	28′0″	29′5″	30′10″	32′2″	33′7″	35′0″	36′5″
Equivalent Rigid Truck Wheel Base	5′6½″	5′9¾″	6′1⅛″	6′4⅜″	6′7⅝″	6′11″	7′2¼″