F. D. CARNEY & C. J. GADD.

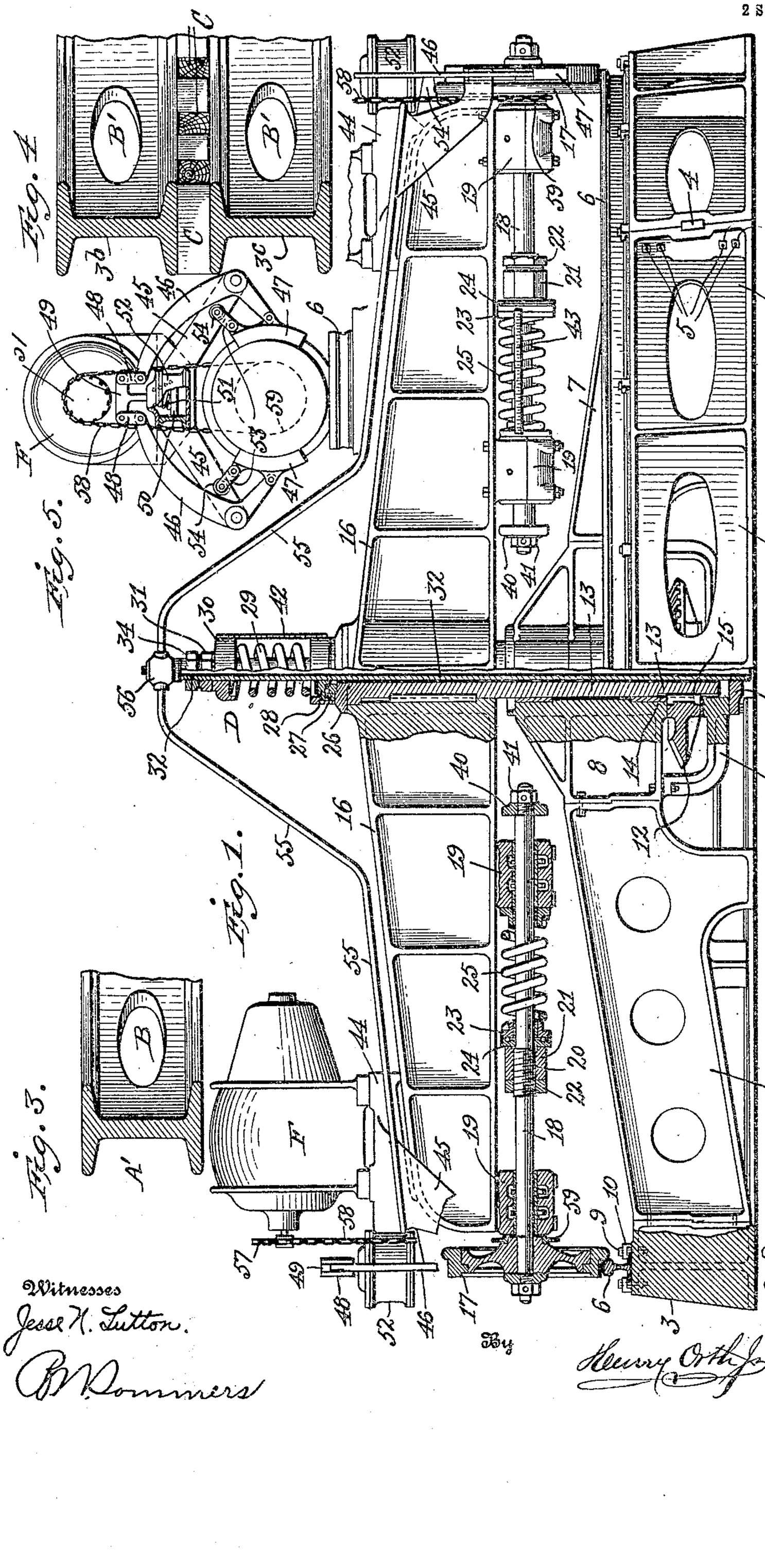
TESTING MACHINE.

APPLICATION FILED NOV. 4, 1908.

955,250.

Patented Apr. 19, 1910

2 SHEETS—SHEET 1.



Witnesses

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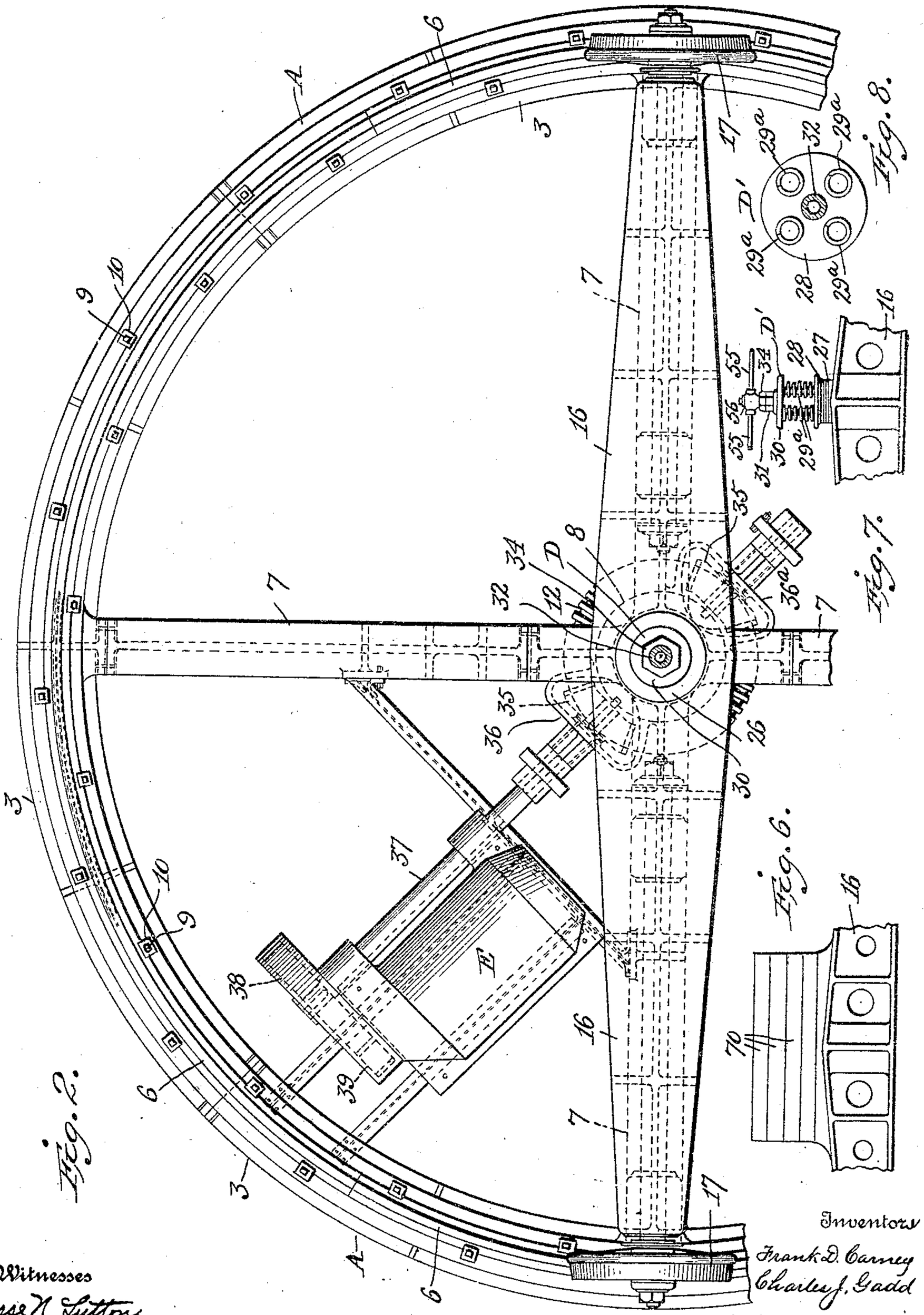

Fig. 8.

Fig. 7.

Fig. 2.

Fig. 6.

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UNITED STATES PATENT OFFICE.

FRANK D. CARNEY AND CHARLES J. GADD, OF STEELTON, PENNSYLVANIA, ASSIGNORS TO THE PENNSYLVANIA STEEL COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

TESTING-MACHINE.

955,250. Specification of Letters Patent. Patented Apr. 19, 1910.

Application filed November 4, 1908. Serial No. 461,058.

To all whom it may concern:

Be it known that we, FRANK D. CARNEY, and CHARLES J. GADD, both citizens of the United States, residing at and whose post-office addresses are Steelton, county of Dauphin, State of Pennsylvania, United States of America, have invented certain new and useful Improvements in Testing-Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Our invention has for its object a machine for testing the endurance of rails under various conditions of railway use, to show the nature of wear and duration of rails of different grades of material.

Referring to the drawings in which like parts are similarly designated, Figure 1 is a view partly in elevation and partly in vertical central section. Fig. 2 is a plan view of a part of the machine sufficient to illustrate the invention. Figs. 3 and 4 illustrate modifications of the frame of the machine forming the bed for supporting the rails. Fig. 5 is an end view, partly in section, of the rotating arm with auxiliary motor and air brake. Figs. 6 and 7 are elevations of modifications of the pressure head, and Fig. 8 is a plan view partly in section to show the relative arrangement of the springs of Fig. 7.

The frame of the machine comprises a circular bed connected by struts to a central bearing in which the circular bed A is formed of metallic sections 3, preferably of cast iron, and these sections are herein shown as being made in quadrants of a circle. The various sections 3 at their ends are provided with recesses in which are inserted fitted keys 4 for the purpose of taking the shear from the bolts 5 that connect the several quadrants to one another. The bed A is preferably of sufficient flexibility to allow enough deflection to give as near as possible the track wave or vertical deflection obtained in actual railway practice. Mounted on the bed A are the specimens of railway rails to be tested and these are made preferably in arcuate sections 6, any number of sections being capable of being mounted on the bed and joined by the customary fishings to form a circular track. These sections, however, are preferably of uniform size, but of different grades of material, in order to show the comparison of the wear under similar conditions. The circular bed A is tied by radial struts 7, here shown as four in number, to a center bearing 8. The character of the base may be varied to increase or diminish both the lateral and vertical deflection and this deflection is influenced by the number of radial struts 7 that may be used, which number may be varied in accordance with the lateral deflection desired to be obtained. What is meant by varying the character of the base is clearly illustrated in Figs. 3 and 4. Fig. 3 shows a standard I-beam A′ which may or may not have its web cut away as shown at B and this form of bed has a greater deflection than the cast iron bed illustrated in Fig. 1. A still greater degree of vertical elasticity as well as lateral deflection is obtained by a bed constructed as shown in Fig. 4, where the base is built up of two I-beams 3^b and 3^c separated by blocks C preferably, but not necessarily of wood, at regular or irregular intervals and one or both of the I-beams may have portions of their web removed as at B′ in order to increase the flexibility of the I-beams. In this manner various track conditions in actual railroad practice can be simulated.

On the bed A are secured, by means of bolts 9 and clamps 10, the railway rails 6. These rails may or may not be separated from the base A by thin spacing pieces of metal, wood or other suitable material, placed between the base and rail so as to lift the rail slightly from the base to give suspended joints and suspended sections of track, whereby the rail sections will not have a continuous support.

Secured to and depending from the center bearing 8 is a bracket 11, supporting the bevel wheel 12 between it and the lower face of the bearing 8. Journaled in bearing 8 is a vertical shaft 13 having a key-way 14

in which is set a spline 15, somewhat shorter than the key-way for connecting the bevel 12 with the shaft 13, and permit slight vertical movement of the shaft with respect to the wheel. The shaft 13 revolves in the bearing 8 and is rigidly fitted with and drives a rotating arm 16 which to serve our purposes, must be extremely rigid, and we preferably make the same a solid casting of steel, nineteen feet long, provided with one or more deep vertical webs, and wide upper and lower flanges on both sides connected by bracing ribs, as clearly shown in Figs. 1 and 2. Mounted at each end of the rotating arm 16 are railway car wheels 17. These wheels 17 are mounted on separate axles 18 that are supported in axle bearings 19, secured to the rotating arm 16 here shown as secured beneath said arm. Each axle 18 is provided with an enlarged threaded portion 20, on which is a nut 21 and lock nut 22. Abutting against the nut 21 is a thrust ball bearing 23, 24 and coming against this bearing is one end of a calibrated coil spring 25, whose opposite end reacts against the inner fixed bearing 19. These bearings 19 are hollow so as to contain a considerable quantity of oil and are of the well known self-oiling type.

Resting on top of the revolving arm 16 is a pressure distributing collar 26. On top of this collar 26 is a pressure head D, for exerting an adjustable vertical pressure on the revolving arm 16, and therethrough to the wheels. This pressure head is made to accommodate any customary arrangement of springs for exerting the pressure required to be placed on the revolving arm. In Fig. 1 is shown a thrust ball bearing 27, 28 between the pressure equalizing collar 26 and one end of a calibrated coil spring 29. On top of the spring 29 is a spring holding device 30, acting as the upper bearing for the spring 29, and on top of this device is a nut 31 engaging the upper threaded end of a stationary hollow or solid tension member or tube 32, whose lower end is threaded into a nut 33, carried by the bracket 11. A lock nut 34 holds the nut 31 in place. In Fig. 6 a number of removable weights 70 are shown in lieu of loading springs and in Fig. 7 there are a plurality of springs 29^a assembled in the pressure head D'.

The rotating arm 16 being rigidly connected to the shaft 13 said arm and shaft may be lifted and lowered by reason of the key-way 14 and key 15 to permit different sized wheels 17, or rails 6, or both to be used in the machine.

Gearing with the bevel wheel 12 is a bevel pinion 35, supported in a bracket 36, at the center bearing 8 and in which is mounted a driving shaft 37 located between a pair of struts 7. This shaft 37 is provided with a gear wheel 38, geared to a pinion 39, on the rotor of an electric motor E. A similar bracket 36^a may or may not be provided diametrically opposite the bracket 36, in order to accommodate a duplicate of the motor E and driving devices connected thereto, thereby increasing the horse-power for driving the rotating arm.

The shafts 18 that carry the car wheels 17 are axially slidable in their bearings 19, and are prevented from entirely sliding out of these bearings, in case a wheel flange should break, by washers 40, held on the inner threaded ends of the axles 18 by nuts 41. The normal working position of the shafts 18 are such that the washers or collars 40 are held distanced from the inner bearings 19 as shown. This arrangement permits centrifugal force, due to the revolution of the arm 16, to be free to act on each wheel 17 in addition to the loading due to the spring 25.

A gage 42, graduated in accordance with the calibration of the spring or springs 29 of the pressure head, is secured either to 28 or to 30 as desired. A similar gage 43 is secured to 23 or to 19 of each car wheel axle. It is obvious that all of these gages may be omitted and the adjustment of the compression of the various calibrated springs may be made by simply measuring the distances between the fixed and the movable elements between which the springs are held.

So much of the machine as above described gives results for ordinary wear of rails under ordinary railway conditions and the operation is as follows: The comparison sections of rail 6 are secured to the bed 3, or A' or 3^b, as the case may be, the bed being designed in accordance with the conditions of the railway bed for which the test is to be determined. The size and style of wheel 7 that is generally used, is secured to the shafts 16. The revolving arm 16, rigidly secured to shaft 13, can be raised and lowered to the limits within which the machine is designed, by reason of the spline 15 and groove 14, forming a sliding connection between the gear wheel 12 and shaft 13. The load designed to be applied to the flanges of the wheels is obtained by placing a spring 25 of the required strength between the thrust bearing 23 and the inner bearing 19. The weight of the parts of the machine and the wheels on the rails being known, a pressure head is selected, whose calibrated spring or springs or whose known dead weights are so chosen, as to give us the desired additional load on the wheels. In Fig. 1 the spring 29 surrounds the tension rod 32 and this tension can be adjusted from zero to its maximum limit by means of the nut 31 and lock nut 34. After having selected the proper pressure head and the proper thrust

springs 25, the motor E is started and the revolving arm 16 is run at that speed for which wear is to be tested.

Actual tests made on this machine with various grades of rail have shown decided variations in wear and by this machine it is possible to vary the thrust of the flange against the rail, vary the speed at which the wheels may travel, vary the load on the wheels, and vary the elasticity of the rails by suitably modifying the supports of the rails 6, so as to obtain lateral deflection of the rails, as well as vertical wave motion of the rails.

Means to simulate as nearly as possible special conditions of wear that occur on railways are also provided, and to this end there is removably mounted on each end of the rotating arm, a saddle 44. This saddle is provided with a pair of brackets 45, one projecting on each side of the end of the rotating arm and extending to the plane of the tread of the wheels 17, more clearly shown in Fig. 5. Pivoted in the ends of brackets 45 are bell-crank levers 46 whose short arms are pivotally connected to brake shoes 47 and whose long arms are connected by links 48 to a cross head 49 of a piston 50 urged by a spring 51 on the upper face of the piston to release the brake. This piston 50 operates in an air cylinder 52 secured to the saddle 44. The brake shoes are connected near their upper ends by links 53, to a stud or boss 54 projecting from brackets 45. Air is supplied to the cylinders 52 below the pistons 50 therein by pipes 55 connected to a revoluble distributer head 56 mounted on the upper end of the hollow stationary rod 32, to the lower threaded end of which an air supply pipe may be connected. This mechanism permits the wheels to be braked and if desired held from any rotation whatever during their revolution about the center of motion of the machine and thus produce the skidding effect due to braking.

On the saddles 44 are mounted auxiliary motors F whose rotors carry chain pinions 57 connected by chains 58 to chain wheels 59 placed on the hubs of the railway car wheels 17 or on the axles of the wheels as is most convenient. These motors F may be used in place of the main motor E to directly drive the car wheels or they may be used in conjunction with said main motor E to produce slippage of the car wheels to simulate the slippage of the drivers of a locomotive when starting or when passing around curves or when the drivers of the locomotive are reversed to check the descent of the train on steep inclines. Thus the car wheel may have imparted to it at will a rotation different from and independent of that rotation which is imparted to the car wheel by reason of its progression along the rails, and this rotation may be either in the same or in the opposite direction to the rotation due to progression.

We claim:

1. In a rail testing machine a circular metallic frame for supporting specimens of railway rails to be tested, a rotary arm mounted centrally of the frame, a shaft to which said arm is rigidly secured and gearing for driving said shaft, the shaft being vertically adjustable with respect to the gearing.

2. In a rail testing machine, a circular metallic frame for supporting specimens of railway rails to be tested, an arm, a shaft substantially central of said arm, gearing to drive the shaft, means to permit the vertical adjustment of the shaft and arm with respect to the gearing, and means to load the shaft and arm independent of the gearing.

3. In a rail testing machine, a circular metallic frame composed of arcuate sections having webs, and the web of each section cut away to give elasticity thereto at symmetrical points about the frame.

4. In a rail testing machine, the combination with a frame including a circular bed upon which the rails are mounted, and a rotating arm mounted in the frame; of means to mount a car wheel at the end of the arm, means to urge the car wheel to produce flange pressure against the head of the rail.

5. In a rail testing machine the combination with a rail support and a support for a car wheel to run on said rail; of means to urge the wheel laterally of the rail, means to load the support and wheel, means to drive the support and means to drive the wheel independently of the driving means for the support.

6. In a rail testing machine, the combination with a rail support or bed and means to support a car wheel on the rail; of means to urge the car wheel laterally of the rail and independently of its supporting means, means to drive the supporting means, means to brake the wheel, and means to drive the wheel independently of the support driving means.

7. In a rail testing machine, the combination with a rail support or bed; of vertically adjustable means to support a car wheel on the rail, adjustable means to urge the wheel laterally of the rail and independently of its supporting means, mechanism to drive the supporting means, means carried by the supporting means to independently drive the wheel, means to brake the wheel, and adjustable means to load the wheel supporting means.

8. In a rail testing machine, the combination with a circular frame, of a hollow shaft centrally mounted in the frame, a stationary

hollow tension member in the shaft, a rotatable arm secured to the shaft, a pressure head mounted on the tension member and exerting pressure on the arm, a brake cylinder at each end of said arm, a distributer head revolubly mounted on the tension member, and pipe connections between the head and brake cylinders.

9. In a rail testing machine, the combination with a circular frame; of a vertical shaft mounted therein, a rotatable arm secured to the shaft, axle bearings secured to the arm, wheel axles mounted on the arm, a spring in operative relation to each axle to urge the axle longitudinally of the arm and means on each axle to regulate the tension of each spring.

10. In a rail testing machine, the combination with a metallic circular frame for supporting rails to be tested; of a vertical shaft mounted therein, a rotatable arm secured to the shaft, a wheel axle mounted at each end of the arm, railway car wheels on each shaft just beyond the ends of said arm, a saddle on each end of the arm, a motor mounted thereon, a chain wheel to drive each car wheel, a chain pinion on the rotor of each motor and a chain between the chain pinion and chain wheel.

11. In a rail testing machine, the combination with a rotatable arm and car wheels carried thereby; of a saddle mounted on each end of the arm, brackets on the saddle, an electric motor and an air brake cylinder on the saddle, a piston in the cylinder, a cross-head connected to the piston, bell crank levers pivotally connected to the brackets and to the cross-head, brake shoes carried by the levers, means to supply air to the cylinder for operating the brakes and means to drive the car wheels from the motor.

12. In a rail testing machine, the combination with a circular bed for the rails and an arm rotating with respect to said bed; of bearings secured to the arm, a wheel axle mounted in said bearings, an adjustable spring to urge said axle toward the free end of the arm, said axle being free to slide longitudinally in the bearings.

13. In a rail testing machine, the combination with a circular bed for the rails and an arm rotating with respect to said bed; of bearings secured to said arm, a wheel axle mounted in said bearings, a screw on the axle, a nut on the screw, a thrust ball bearing adjacent the nut, a calibrated coil spring between the thrust bearing and one of the axle bearings and means to limit the axial movement of the axle.

14. In a rail testing machine, the combination with a rail support, a car wheel support, and a car wheel mounted therein; of calibrated means to urge the car wheel laterally of the rail support to exert flange pressure on the rail, calibrated means to variously load the wheel support, and means to drive the wheel support.

15. In a rail testing machine, the combination with a circular metallic frame supporting rail to be tested and a rotating arm mounted centrally of the frame; of means to mount railway car wheels at the ends of the arm to roll on the rails whereby the weight carried by said wheels will be uniformly distributed to them, adjustable calibrated means to additionally load the arm and means to drive said arm.

16. The combination with a rail support; of a support for a car wheel, a car wheel mounted therein, driving means for the car wheel support, whereby both rotation and progression are imparted to the wheel, and means independent of said driving means to alter the speed of rotation of the wheel without changing the speed of progression at will.

17. In a rail testing machine a circular metallic bed having a web, said bed to support rails to be tested and the web of the bed cut away at points to give elasticity to the bed.

18. In a rail testing machine a circular sectional metallic bed, having portions of the web of each section cut away, a central bearing and struts symmetrically arranged and connecting the bearing and bed.

19. In combination a metallic bed having a web and portions of the web cut away at intervals to render the bed elastic, and means to support and move a car wheel on rails to be tested secured on the bed.

In testimony that we claim the foregoing as our invention, we have signed our names in presence of two subscribing witnesses.

FRANK D. CARNEY.
CHARLES J. GADD.

Witnesses:
GEO. W. PARSONS,
HOMER L. LITZENBERG.