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

TESTING MACHINE.

APPLICATION FILED NOV. 4, 1908.

**955,630.** **Patented Apr. 19, 1910.**

2 SHEETS—SHEET 1.

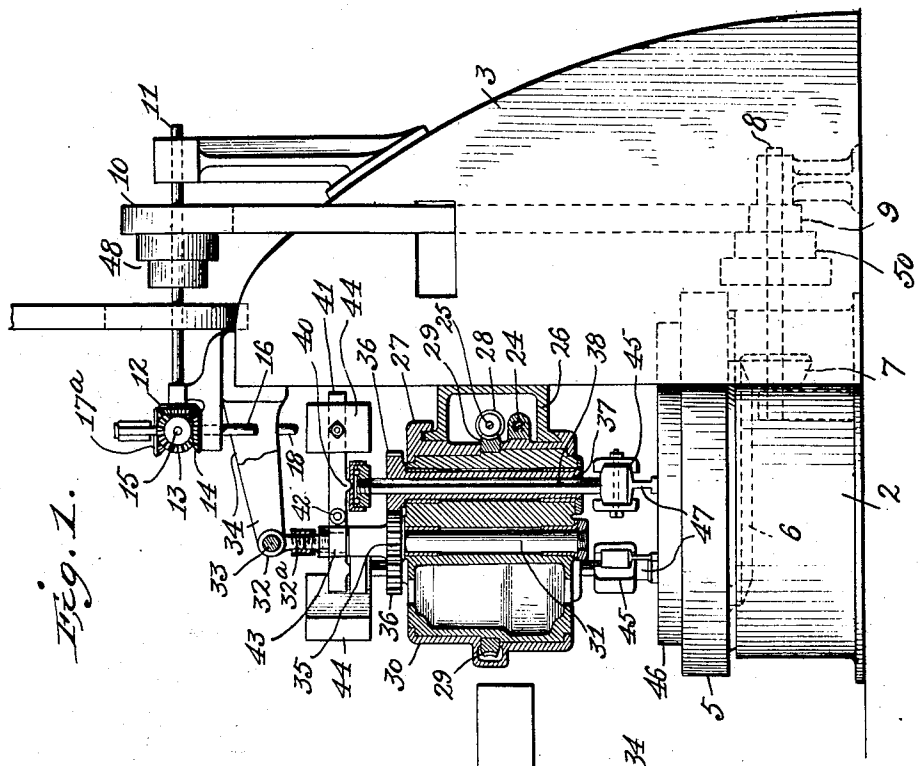

Fig. 1.

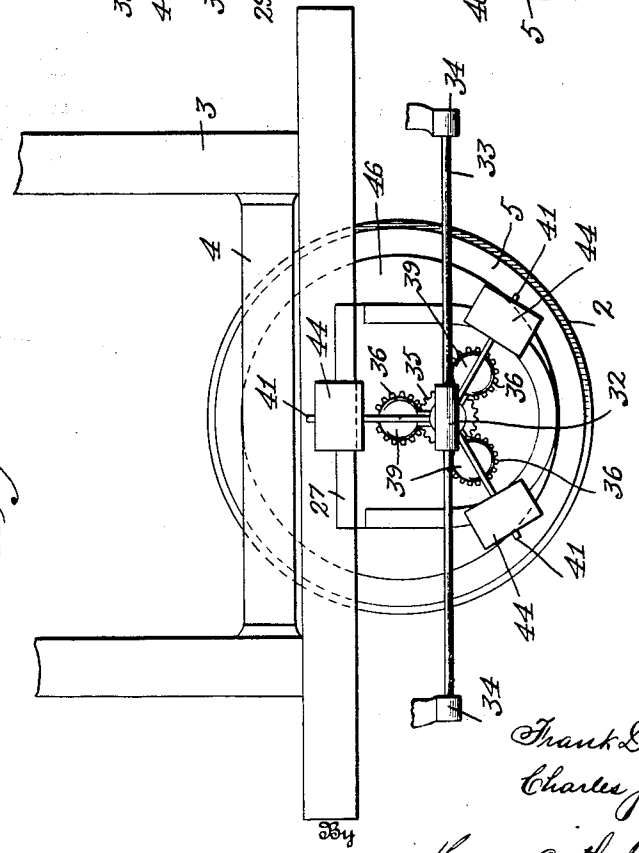

Fig. 3.

Witnesses

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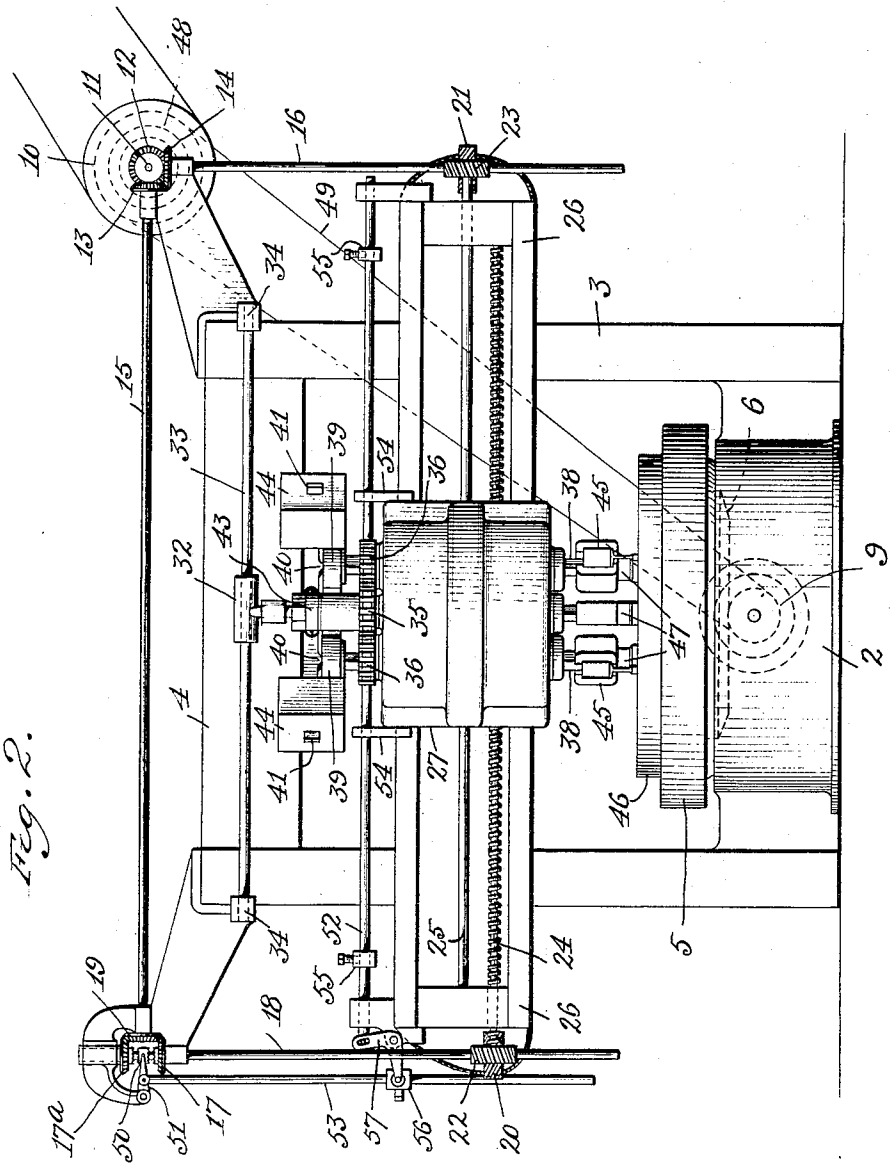

Fig. 2.

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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.

955,630. Specification of Letters Patent. **Patented Apr. 19, 1910.**

Application filed November 4, 1908. Serial No. 461,059.

*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 address is 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.

This invention relates to machines for experimentally testing the frictional wear between any two desired substances and to this end embodies a movable or rotatable bed, traversable means containing the test-piece supports, and mechanism to simultaneously rotate and revolve said supports, together with details of construction hereinafter described and particularly pointed out in the claims.

Referring to the drawings in which like parts are similarly designated, Figure 1 is a view partly in side elevation and partly in vertical section embodying the invention. Fig. 2 is a front elevation of the same. Fig. 3 is a plan of so much of the machine as is necessary for an understanding of the invention.

The frame 2 is provided with lateral housings 3 connected together at their top by a tie rail 4. On the frame 2 is a movable table and preferably, but not necessarily, a rotating table or bed 5 provided on its under side with a bevel gear wheel 6 meshing with a pinion 7 on a shaft 8 that is provided with a stepped belt pulley 9 driven by a belt 10 which belt is in turn driven from a stepped pulley 48 on the main driving shaft 11. This shaft is provided with a miter gear 12 meshing with two miter gears 13 and 14 on shafts 15 and 16 respectively. The shaft 15 has at its opposite end a miter gear 19 meshing with one 17 on the vertical shaft 18 on the opposite side of machine. The vertical shafts 18 and 16 are provided with slidable spiral gears 20 and 21 respectively, meshing with spiral gears 22 and 23 on shafts 24 and 25. The shafts 24 and 25 are mounted in a cross rail 26 which is vertically adjustable on the housings 3, and which carries the cases in which the gears 20 and 22, and 21 and 23 are mounted. The shafts 16 and 18 are capable of sliding through the spiral gears 20 and 21 mounted on them respectively. The parts above described are common to well known boring machines and form no part of the present invention.

For the purposes of this invention the miter gear wheel 17 is loose on shaft 18 and has opposite it a similar miter wheel $17^a$ also loose on said shaft. Both of these miter wheels are in engagement with the miter wheel 19 and are capable of being clutched to the shaft by a clutch member 50, that is carried by a pivoted arm 51 connected to a rod 53. On the rod 53 is a vertically adjustable block 56 engaged by a bell crank lever 57 mounted on the end of the vertically adjustable cross rail 26. Cross rail 26 carries a saddle 27, in which is mounted mechanism presently to be described. The upper shaft 25 that is mounted in the rail 26, carries a worm 28 that meshes with a worm wheel 29 rigidly secured to a drum 30 mounted in the saddle 27. The worm 28 is slidably connected to shaft 25 in any well known manner. Through the center of drum 30 passes a stationary central suspending pin 31 connected by a threaded shank $32^a$ to a sleeve 32 slidably held on a stationary rod 33 mounted in brackets 34 extending from the housings of the machine.

Rigidly secured to the pin 31 is a stationary spur wheel 35 with which meshes one or more gear wheels or pinions 36 there being three such pinions 36 shown in the drawings. Each of these pinions 36 is connected to a sleeve 37 and the sleeves themselves are mounted in the drum so as to be capable of rotation. The pinions 36 act as planet gears with respect to spur wheel 35 and rotate the sleeves 37 when drum 30 is rotated.

Slidably, but not rotatively mounted in

each sleeve 37 is a shaft 38, shown as a square shaft, having at its upper end a thrust ball bearing 39 engaged by lug 40 on a lever 41 pivoted at 42 to a rotatable collar 43 or other suitable device on the suspending pin 31. On each lever 41 is mounted an adjustable weight 44. On the bottom of each of the square shafts 38, carried in the sleeves 37 is a clutch 45 of any suitable form, in which is clamped the piece of material to be tested. On the bed 5 is secured the wearing surface 46 against which the specimens being tested, or shapes used for the purpose of the test, and here shown by way of example as sections of rail 47, are pressed by reason of the weights 44, acting on the thrust bearings on the upper ends of the square shafts 38. The saddle 27 has fixed to it lugs 54 that slide on rod 52 mounted on the cross rail 26, said lugs capable of striking adjustable stops 55 on rod 52 to move said rod to actuate the bell crank lever 57 and its connections to throw the clutch 50 at the end of each traverse of the saddle 26.

The operation of the machine is as follows: Power is applied to the driving shaft 11. This shaft 11 carries the step pulley 48 that drives by belt 49 the similar pulley 50 on the shaft 8, on which is mounted the bevel pinion 7 for driving the bevel gear 6 on the table 5 to rotate said table, and to which table is secured the wear surface 46. At the same time the driving shaft 11 transmits power through miter gears 13 and 14 to shafts 15 and 16. Shaft 16 drives through the spiral gears 21 and 23 the shaft 25 which in turn actuates the worm to drive the drum 30; while shaft 15 drives the miter gear 19 to rotate the miter gears 17 and 17ª. Said miter wheels 17 or 17ª being capable of being clutched to shaft 18 by means of clutch 50 that is operated by a lever 51 which is moved by the rod 53. The rod 53 is moved by the bell crank lever 56 while the latter is actuated by rod 52 when the lugs 54 mounted on saddle 27 contact with the adjustable stops 55 mounted on rod 52. Upon such contact continued movement of the saddle changes the clutch engagement to reverse the direction of movement of the shaft 18. The shaft 18 then through spiral gears 20 and 22 rotates the screw 24 in the one or the other direction to traverse the saddle 27. The specimens or samples 47 are therefore traversed across the bed, revolved about the center of the suspending pin 31 and at the same time given rotary motion about the center of shafts 38, while at the same time the wear plate 46 is rotated. The effect of these various movements of the specimens is to produce a rubbing action between one or more specimens held or secured on the ends of shafts 38 and urged against the wear plate 46. This is especially valuable in causing friction between different specimens of material, and the standard or selected specimens, here shown, are sections of rails 47 wearing against a plate 46. Specimens 47 are of different degrees of hardness or processes of manufacture. Any material may be so tested by being held to the ends of shafts 38, or the qualities of lubricants may be tested between suitable upper and lower surfaces.

We claim:

1. In a testing machine, the combination with a rotatable bed; of means above the bed and perpendicular thereto to support a specimen to be tested, means to revolve the supporting means, means actuated by the revolution of the supporting means to simultaneously and continuously rotate said supporting means about its axis, and means traveling with the supporting means to uniformly load it.

2. In a testing machine, the combination with a rotatable bed; of a slidable spindle perpendicular to the bed to support a specimen to be tested, means to continuously revolve the supporting means, and means actuated by the revolution of the supporting means to simultaneously and continuously rotate said supporting means.

3. In a testing machine, the combination with a movable bed; of a spindle free to slide longitudinally to support a specimen to be tested in frictional relation to the bed, means to continuously revolve the supporting means, means actuated by the revolution of the supporting means to simultaneously and continuously rotate said supporting means about its axis, and means to move the bed during the revolution and rotation of the supporting means.

4. In a testing machine, the combination with a movable bed; of means perpendicular to the bed to support a specimen to be tested, means to continuously revolve the supporting means, means to simultaneously and continuously rotate said supporting means during the revolution thereof, means to traverse the supporting means across the bed, and means to continuously move the bed during the simultaneous revolution and rotation of the supporting means.

5. In a testing machine the combination with a rotatable bed; of means to support a specimen to be tested in frictional contact with the bed, means to revolve the supporting means, means actuated by the revolution of the supporting means to simultaneously rotate said supporting means and means to rotate the bed during the revolution and rotation of the supporting means.

6. In a testing machine the combination with a rotatable bed; of means perpendicular to the bed to support a specimen to be tested, means to revolve the supporting

means, means actuated by the revolution of the supporting means to simultaneously rotate said supporting means and means to rotate the bed during the revolution and rotation of the supporting means.

7. In a testing machine the combination with a bed; of means to support a specimen to be tested in frictional contact with the bed, means to continuously revolve the supporting means, means actuated by the revolution of the supporting means to simultaneously and continuously rotate said supporting means, and means to traverse the supporting means during the rotation and revolution thereof.

8. In a testing machine the combination with a movable bed; of means to support a specimen to be tested in frictional relation to the bed, means to revolve the supporting means, means actuated by the revolution of the supporting means to simultaneously rotate said supporting means about its axis and means to traverse the supporting means during the rotation and revolution thereof.

9. In a testing machine the combination with a movable bed; of means perpendicular to the bed to support a specimen to be tested, means to revolve the supporting means, means to simultaneously rotate said supporting means during the revolution thereof, means to continuously move the bed during the simultaneous revolution and rotation of the supporting means, and means to traverse the supporting means during the rotation and revolution thereof.

10. In a testing machine the combination with a rotatable bed; of means to support a specimen to be tested, means to revolve the supporting means, means actuated by the revolution of the supporting means to simultaneously rotate said supporting means, means to rotate the bed during the revolution and rotation of the supporting means and means to traverse the supporting means during the rotation and revolution thereof.

11. In a testing machine, the combination with a bed and means to rotate it; of a specimen support perpendicular to the bed, a pivoted arm extending over and acting on the upper end of the support to force it toward the bed, means to adjustably load said arm and means to rotate the support during the rotation of the bed.

12. In a testing machine, the combination with a bed; of a specimen support perpendicular to the face of the bed, an adjustable, revoluble loading means for the support, constant under all conditions of test, and mechanism to simultaneously rotate and revolve the support, said loading means engaging and traveling with the support.

13. In a testing machine the combination with a bed; of a specimen support perpendicular to the bed and free to move longitudinally, means to load the same, means to rotate and revolve the support, and means to traverse the support.

14. In a testing machine, a rotatably supported drum, a stationary gear wheel, a sleeve rotatably mounted in the drum, a gear wheel on the sleeve acting as a planet gear with respect to the stationary gear wheel, a shaft slidably mounted in the sleeve, means to load the shaft and means to rotate the drum.

15. In a testing machine, a drum, a central pin, on which the drum is rotatably mounted, a plurality of sleeves rotatably mounted in the drum, a stationary gear wheel on the pin, planet gear wheels on the sleeves, shafts slidably mounted in the sleeves, a collar revoluble about the pin, lever arms pivotally connected to the collar and engaging the ends of the shafts and weights adjustable on the lever arms.

16. In a testing machine, a vertically adjustable rail, a saddle longitudinally slidable on the rail, a drum in the saddle, a suspending pin on which the drum revolves, sleeves revolubly mounted in the drum, a stationary gear wheel on the pin and planet gear wheels on the sleeves, shafts slidable but not rotatable in the sleeves, thrust bearings at the upper ends of the shafts, a collar rotatable in the pin, levers pivoted to the collar and engaging the bearings, weights adjustable on the levers, means to rotate the drum and means simultaneously to traverse the saddle.

17. In a testing machine the combination with a bed; of means perpendicular to the bed to support a specimen to be tested, means actuated by the revolution of the supporting means to simultaneously rotate said supporting means, and means to load the supporting means during the rotation and revolution thereof.

18. In a testing machine the combination with a bed; of means perpendicular to the bed to support a specimen to be tested, means actuated by the revolution of the supporting means to simultaneously rotate said supporting means, and means to adjustably load the supporting means during the rotation and revolution thereof.

19. In a testing machine the combination with a movable bed; of means to support a specimen to be tested in frictional relation to the bed, means to revolve the supporting means, means actuated by the revolution of the supporting means to simultaneously rotate said supporting means about its axis, means to move the bed during the revolution and rotation of the supporting means, and means to load the supporting means during the rotation and revolution thereof.

20. In a testing machine the combination with a movable bed, of means perpendicular

to the bed to support a specimen to be tested, means to revolve the supporting means, means to simultaneously rotate said supporting means during the revolution thereof, means to continuously move the bed during the simultaneous revolution and rotation of the supporting means, and weighted lever arms to load the supporting means during the rotation thereof.

21. In a testing machine the combination with a rotatable bed; of means to support a specimen to be tested, means to revolve the supporting means, means actuated by the revolution of the supporting means to simultaneously rotate said supporting means, means to rotate the bed during the revolution and rotation of the supporting means, and means to load the supporting means during the rotation and revolution thereof.

22. In a testing machine the combination with a rotatable bed; of means to support a specimen to be tested; means to revolve the supporting means, means actuated by the revolution of the supporting means to simultaneously rotate said supporting means, means to rotate the bed during the revolution and rotation of the supporting means, and weighted lever arms to load the supporting means during the rotation and revolution thereof.

23. In a testing machine the combination with a bed; of means to support a specimen to be tested, means to revolve the supporting means, means actuated by the revolution of the supporting means to simultaneously rotate said supporting means, means to traverse the supporting means during the rotation and revolution thereof and means to load the supporting means, during its traverse, rotation and revolution.

24. In combination, a bed, a spindle free to rise under all conditions of operation and in operative relation to the bed, means to revolve the spindle, and mechanism actuated by the revolving means to rotate the spindle, a pivoted, revoluble arm to load the spindle, said arm revolving in unison with the spindle, and an anti-friction bearing between the arm and spindle.

25. In combination a rotatable bed, a spindle perpendicular to the bed and free to move longitudinally, means to load the spindle, means to revolve the spindle and means actuated by the revolution of the spindle to rotate it.

26. In combination, a continuously rotatable bed, a spindle perpendicular to the bed and free to move longitudinally, means to continuously revolve the spindle, means to continuously rotate it and actuated by revolution of the spindle, and means rotated with the spindle to uniformly load it.

27. In combination, a rotatable bed, a spindle perpendicular to the bed and free to move longitudinally, adjustable means to load the spindle, means to revolve the spindle and means actuated by revolution of the spindle to rotate it.

28. In combination, a continuously rotatable bed, a spindle perpendicular to the bed and free to move longitudinally, means to continuously revolve the spindle, means actuated by the revolution of the spindle to rotate it, means rotated with the spindle to adjustably and uniformly load it and means to continuously traverse the spindle across the bed during its rotation and revolution.

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.