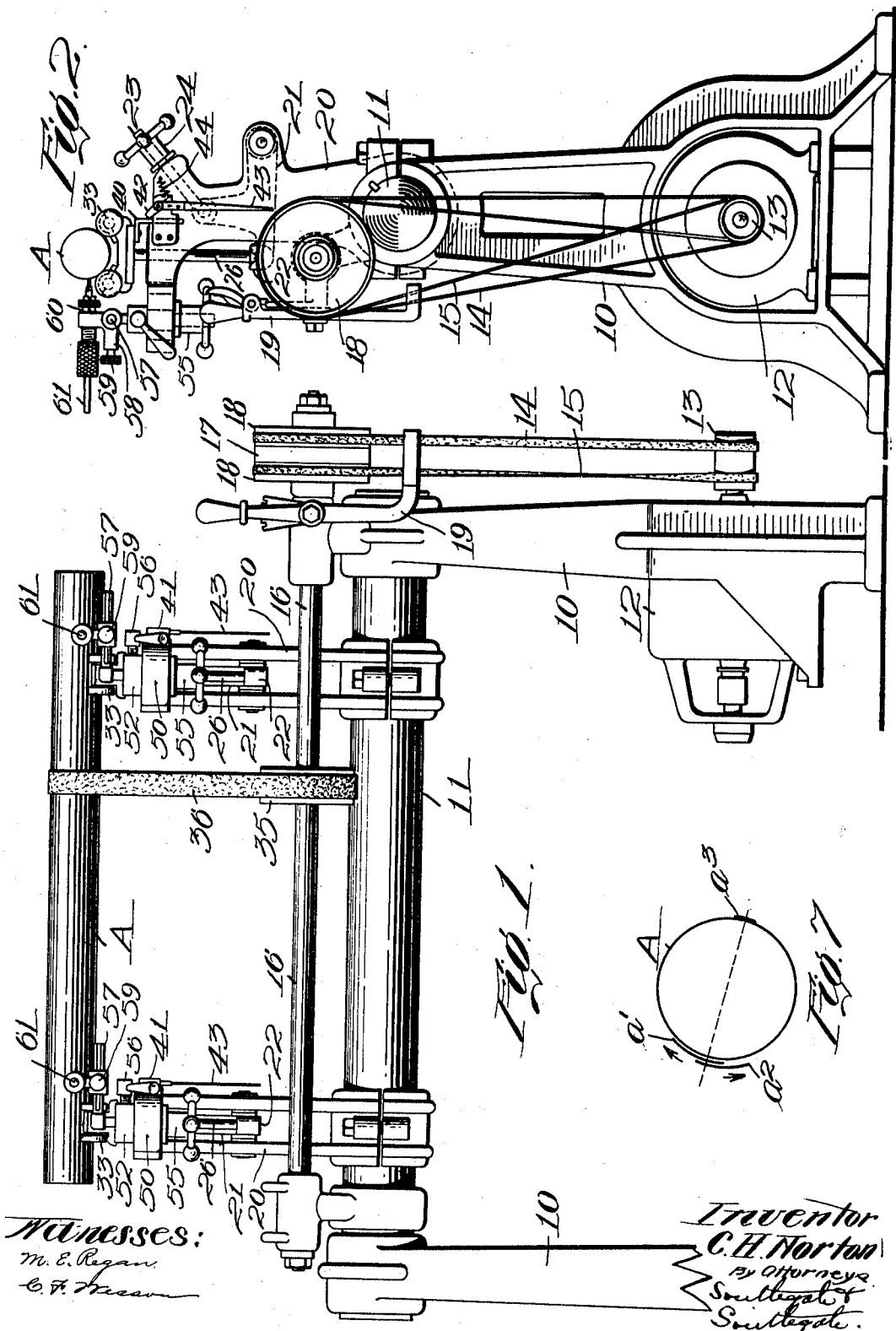


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BALANCING MACHINE FOR ROTATABLE BODIES.
APPLICATION FILED AUG. 30, 1909.

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2 SHEETS—SHEET 1.

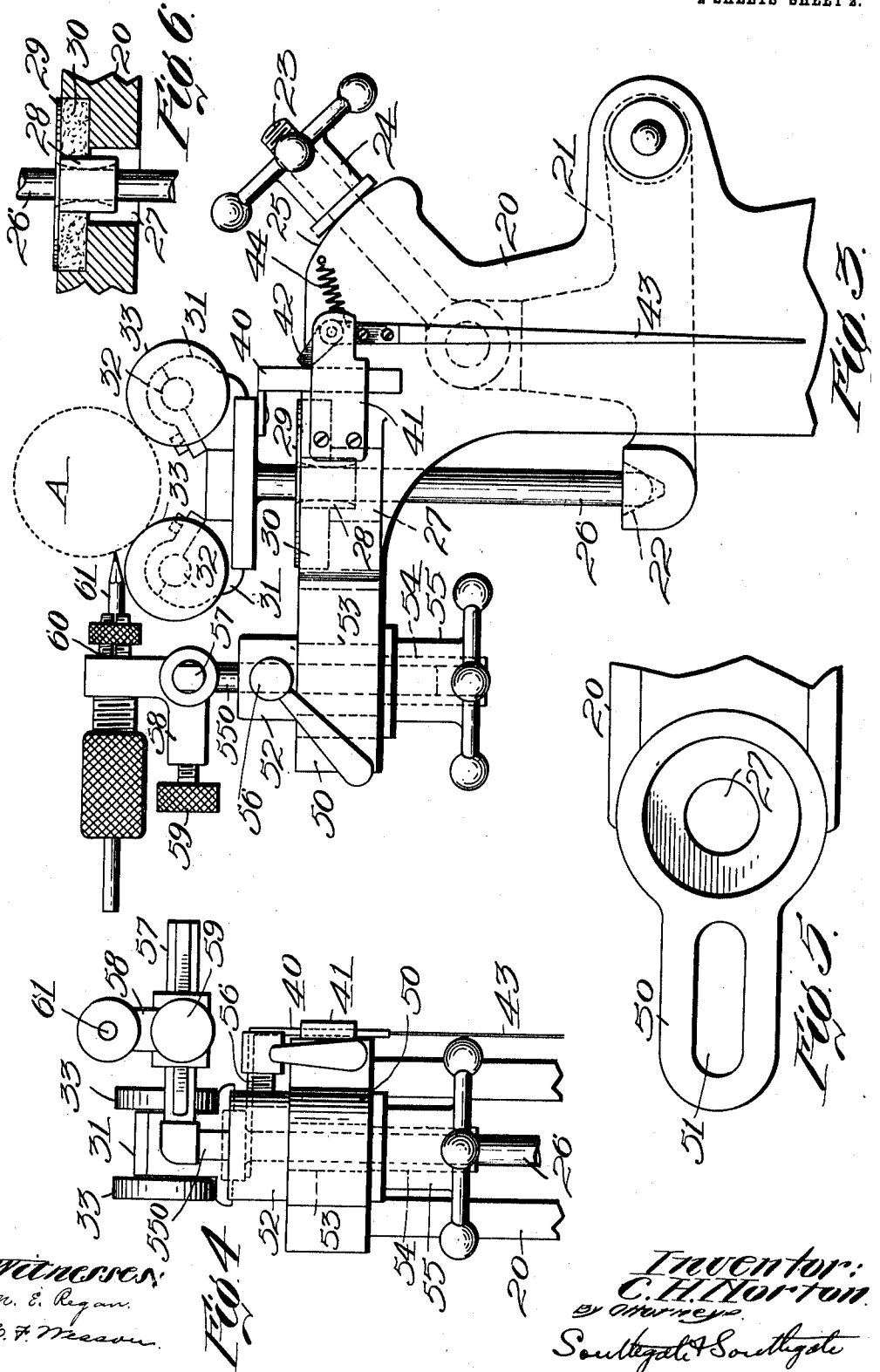


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2 SHEETS—SHEET 2.



Witnesses:
M. E. Regan.
C. F. Mason.

Inventor:
C. H. Norton.
By Murray.
Southgate & Southgate

UNITED STATES PATENT OFFICE.

CHARLES H. NORTON, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO NORTON GRINDING COMPANY, A CORPORATION OF MASSACHUSETTS.

BALANCING-MACHINE FOR ROTATABLE BODIES.

982,629.

Specification of Letters Patent.

Patented Jan. 24, 1911.

Application filed August 30, 1909. Serial No. 515,137.

To all whom it may concern:

Be it known that I, CHARLES H. NORTON, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Balancing-Machine for Rotatable Bodies, of which the following is a specification.

This invention relates to a machine for putting crank shafts, wheels and all other rotatable bodies into a condition of running balance. Heretofore, it has generally been customary to balance up said bodies so as to be in balance statically, but this does not insure a perfect balance when running because two points of excess weight for example, might occur at opposite sides and opposite ends, in which case the body would be in static balance but not in running balance. The principal object of this invention is to provide practical and efficient means for putting rotatable bodies into perfect running balance. For the purpose of accomplishing the above mentioned object, the invention involves means whereby the body to be balanced can be caused to rotate while supported by a vibrating support and means for indicating the place at which the body is out of balance in a most rapid and accurate manner, and means whereby when the body has been brought into a perfect running balance, that fact will be indicated in an unmistakable way.

Further objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings in which,

Figure 1 is a front elevation of a machine constructed in accordance with this invention. Fig. 2 is an end elevation thereof. Fig. 3 is an enlarged view of a portion of the end elevation. Fig. 4 is a front view of the same. Fig. 5 is a plan of a portion of the same. Fig. 6 is a sectional view of a detail thereof, and Fig. 7 is a diagrammatic view indicating the result of the use of the machine.

The machine is illustrated as comprising a substantially rigid frame consisting of end uprights or legs 10 and a body 11. On one of the legs 10 is shown a motor 12 for operating the machine. Over the pulley 13 of this

motor pass straight and crossed belts 14 and 15 and supported by the frame is a main shaft 16 having a tight pulley 17 and two loose pulleys 18. A belt shifter 19 is employed which can be used in an obvious manner to move both belts simultaneously so as to bring either one of them on the tight pulley or both of them on the loose pulleys. In this way it will be seen that the main shaft 16 can be rotated in either direction without stopping the motor or interfering with any other elements which may be in place on the machine.

Rigidly mounted on the body 11 of the frame are shown a pair of upright supports 20. Each of these supports carries an adjustable lever 21 pivoted on the support and having a cup bearing 22 at one end opening upwardly. Each lever is also provided with a screw 23 and a hand nut 24 bearing on a convex surface 25 of the support by which the lever can be adjusted and the height of the bearing 22 regulated. Supported in said bearing 22 is a vertical vibrator 26 which extends upwardly through an enlarged passage 27 in the support. Surrounding this vibrator near the upper end is a bearing 28 having inwardly convex surfaces for engaging the vibrator. This bearing has a flange or plate 29 extending from it and supported by a rubber cushion 30 which is carried in a recess in the support 20. On account of this construction, it will be obvious that the vibrator is free to vibrate at its upper end, within certain limits while its lower end rotates in the bearing 22 and is prevented from vibrating.

Mounted on each vibrator are two bearings 31 which carry shafts 32 on each of which are two anti-friction rollers 33. The body A which is to be balanced is placed so as to rest on the several rollers 33 of the two vibrators and it is rotated by means of a pulley 35 on the main shaft 16 and a belt 36 which conveniently may be made of rubber or other elastic material so as to be capable of yielding slightly upon adjustment of the parts.

Projecting from the upper part of the vibrator is a bracket 40 which extends between the support 20 and a guard 41 mounted on the support. This guard prevents all

tendency on the part of the vibrator itself to turn. Pivotaly mounted on each support is an indicator having a short arm 42 engaging the bracket 40 and a long indicating pointer 43, the arm and pointer being rigidly connected with each other. A spring 44 is shown for an obvious purpose.

It will be seen that the vibration of the upper end of the vibrator will be transmitted to the indicator and multiplied very materially so that the least vibration of the body A will be indicated by the oscillation of the pointer 43. It will be obvious also that when this pointer remains stationary during the rotation of the body A it will indicate that that end of the body is in running balance and when both pointers are stationary, it will show that the entire body is in that condition.

It is obvious that the mere indication of the fact that the body is out of balance will be of small value unless some means is provided for showing what part of the body is too heavy or too light and for that purpose the following mechanism is provided.

Extending from each support 20 is a projection 50 having a longitudinal slot 51 therethrough. Extending through this slot is a member consisting of three parts; a head 52, a body 53 and a reduced end 54. The body 53 is located in the slot, the head above it, and the end 54 below it. This end is externally screw-threaded and a hand nut 55 is provided so that when this member has been adjusted to the proper position along the slot 51, the nut can be tightened and the parts securely held in adjusted position. This member is provided with a longitudinal passage therethrough in which fits a pencil chuck stud 550. On the head 52 is mounted a hand screw 56 for binding on the stud to hold it in its vertically adjusted positions. This stud is provided with a horizontal projection 57 along which is adapted to move a pencil chuck holder 58 having a screw 59 for securing it in adjusted position. It will be obvious that the projection 57 of the stud can be turned end for end by turning the stud 180 degrees, so that there is a wide range of adjustment. Mounted on the chuck holder is a chuck 60 for holding a pencil 61 or other marker in position to engage the body A which is to be balanced.

Reference to Fig. 7 will show how the marker is employed. When the body A is out of balance, it is obvious that the vibration caused when the body is rotating will result in causing the light side of the body to be projected toward the marker so that there will be a mark as for instance, a' on the body. Then when the rotation of the body is reversed by means of the belt shifter 19, another mark as a^2 will appear on the

body. The heavy spot on the body which is being balanced will be found at a^3 directly opposite a point half-way between the extremities of these two lines a' and a^2 . It will be understood, of course, that each end of the rotating body is balanced in the same way.

I am aware that this invention can be employed for balancing crank shafts, wheels and various other rotatable bodies, either of regular or irregular shape and that the details of construction can be varied within wide limits without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to all the details of construction shown and described nor to the use of the machine for balancing any particular class of articles, but

What I do claim is:—

1. In a machine for balancing rotatable bodies, the combination of a frame, a motor supported thereby, a horizontal shaft carried by the frame independently of the motor, means for rotating the shaft from the motor, a reversing means on the frame for reversing the direction of rotation of the shaft without reversing the motor, a vertical vibratory support movably mounted on the frame for the body to be rotated, and an endless connection extending from the shaft to the body for rotating said body.

2. In a device of the character described, the combination of a frame, a pair of supports mounted thereon, each having a bearing; a vibrator resting at its lower end in each of said bearings, said supports having means for yieldingly holding the upper ends of said vibrators to permit them to vibrate, means on the vibrators for supporting the body to be balanced, and means on the frame for rotating the body when supported by the vibrators.

3. In a device of the character described, the combination of a frame, a pair of supports mounted thereon, each having a bearing, a vibrator comprising an upright member resting at its lower end in each of said bearings, said supports having means for yieldingly holding the upper ends of said vibrators to permit them to vibrate, means on the vibrators for supporting the opposite ends of the body to be balanced, and means on the frame for rotating the body when supported by the vibrators.

4. In a device of the class described, the combination of a frame, a pair of supports thereon, a lever pivotaly mounted on each support and having a cup bearing thereon, means for adjusting the position of said levers about their pivots, a vertical vibrator resting at its lower end in each of said cup bearings, said supports having a passage therethrough for each of the vibrators and a

yielding bearing in said passage for permitting the vibrators to vibrate at their upper ends, means carried by the vibrators for supporting the body to be balanced, and means for rotating said body.

5. In a device for balancing rotatable bodies, the combination of a vibrator, means for supporting the lower end thereof, a bearing for the upper end of the vibrator, means for supporting said bearing, and a yielding cushion surrounding said bearing to permit a vibratory motion of the vibrator, and means on said vibrator for supporting the body to be balanced in position to rotate on a transverse axis.

6. In a device for balancing rotatable bodies, the combination of a vibrator, a bearing therefor having a plate or flange extending outwardly at one end thereof, a rubber cushion on which said flange rests, a frame having an enlarged opening for the vibrator and bearing and provided with a seat for said rubber cushion, means for supporting the body to be balanced on a vibrator, and means independent of the vibrator for rotating said body on an axis transverse to that of the vibrator.

7. In a device for balancing rotatable bodies, the combination of a cup bearing, a vibrator resting at its lower end in said bearing and projecting upwardly therefrom, means on the vibrator for supporting the body to be balanced, and means independent of the vibrator for rotating said body on a horizontal axis.

8. In a device for balancing rotatable bodies, the combination of a vibrator, means for supporting one end thereof, a bearing for the opposite end having an internal convex bearing surface, means for supporting said bearing, and a rubber cushion on which said supporting means rests, said vibrator having means for carrying said body to be balanced.

9. In a device for balancing rotatable bodies, the combination of a vibrator, means for supporting one end thereof, and a bearing for the opposite end having an internal convex bearing surface, said vibrator having means for carrying said body to be balanced.

10. In a machine for balancing rotatable bodies, the combination of a vibrator adapted to support the body to be balanced, a yielding bearing for one end of the vibrator, and an adjustable bearing for the other end.

11. In a machine for balancing rotatable bodies, the combination of a vibrator adapted to support the body to be balanced, a yielding bearing for one end of the vibrator, an unyielding bearing for the other end and means for adjusting the unyielding bearing toward and from the yielding bearing.

12. In a device for balancing rotatable bodies, the combination of a vibrator, a support for the lower end thereof, means for

yieldingly supporting the upper end of the vibrator, means on the vibrator for rotatably supporting the body to be balanced, and means for preventing the vibrator from turning on its axis.

13. In a machine for balancing rotatable bodies, the combination of a vibrator adapted to support the body to be balanced, a yielding bearing for one end of the vibrator, a bearing for the other end, a bracket rigidly mounted on said vibrator, and a guard for said bracket for preventing the vibrator from turning and means for adjusting the unyielding bearing.

14. In a device for balancing rotatable bodies, the combination of a vertical vibrator, means for yieldingly supporting the upper end of the vibrator, means on the vibrator for rotatably supporting the body to be balanced, means for preventing the vibrator from turning on its axis, and an indicator in position to be operated by the vibrator and having a long pointer.

15. In a device for balancing rotatable bodies, the combination of a vibrator, a yielding bearing for one end thereof, means on the vibrator for supporting the body to be balanced, a bracket projecting from the vibrator, means engaging said bracket for preventing the vibrator from turning, and an indicator in position to be operated by the bracket for showing the vibration of the vibrator.

16. In a device for balancing rotatable bodies, the combination of a vibrator, means on the vibrator for supporting the body to be balanced, means for rotating the body, a pivoted indicator having a short arm adapted to be engaged by the vibrator and provided with a long pointer rigid with the arm for indicating the vibration of the vibrator.

17. In a machine for balancing rotatable bodies, the combination of a vibrator, a yielding bearing for one end thereof, means on the vibrator for rotatably supporting the body to be balanced, a pointer in position to be moved by the vibrator for indicating the vibration thereof, and an adjustable marker located adjacent to the vibrator in position to engage the body supported thereby.

18. In a device for balancing rotatable bodies, the combination of a frame, a vibrator carried by the frame, means on the vibrator for carrying the body to be balanced, said frame having a projection thereon provided with a slot, a stud extending through said slot, means for securing the stud in adjusted positions on the slot, said stud being vertically movable, means for securing the stud in vertically adjustable positions, and a marker adjustably mounted on the stud for marking the body to be balanced.

19. In a device for balancing rotatable bodies, the combination of a frame, a vibra-

tor, means on the vibrator for carrying the
body to be balanced, said frame having a
slot, a stud extending through said slot,
means for securing the stud in adjusted po-
5 sitions in the slot, and a marker adjustably
mounted on the stud for marking the body
to be balanced.

In testimony whereof I have hereunto set
my hand, in the presence of two subscribing
witnesses.

CHARLES H. NORTON.

Witnesses:

C. O. SMITH,
ALBERT TURNER.