Dec. 7, 1943. E. I. WENGER 2,336,429

BALANCING MACHINE ATTACHMENT

Filed May 12, 1941

Fig. 1

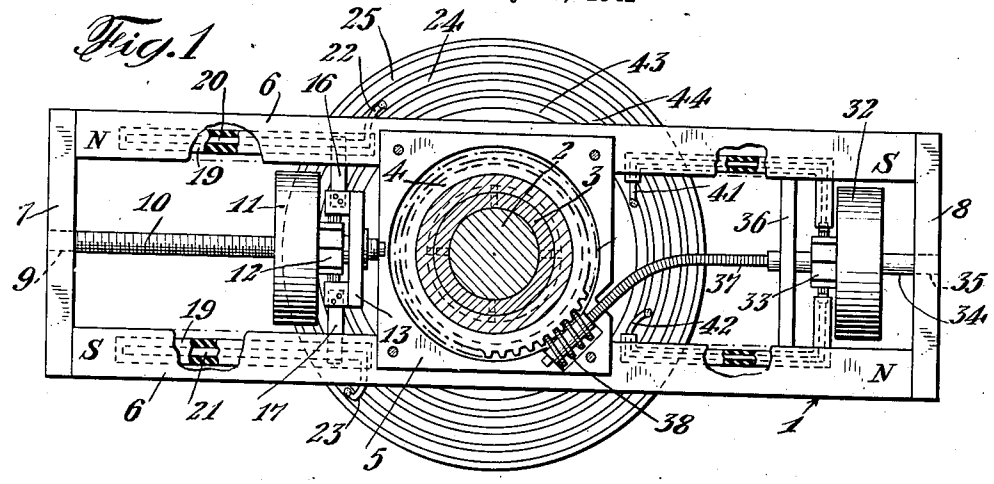


Fig. 2

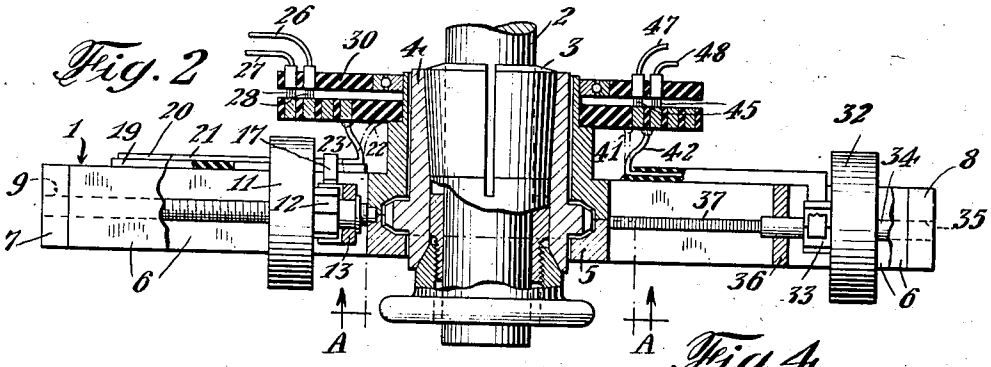


Fig. 4

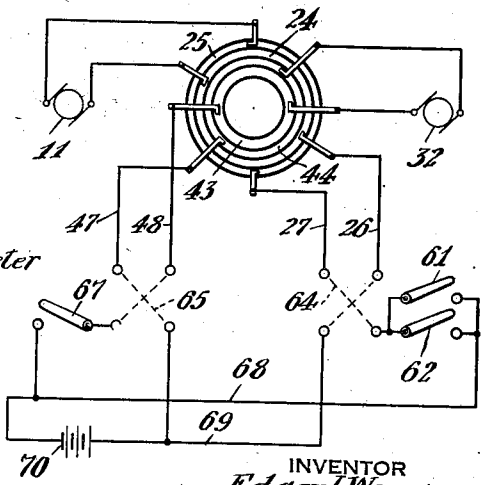
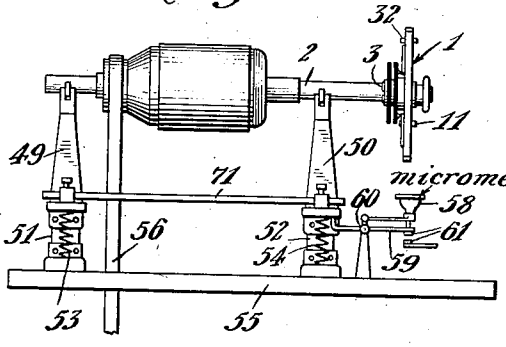


Fig. 3



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BALANCING MACHINE ATTACHMENT

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2 Claims. (Cl. 73—53)

My invention relates to balancing machines and attachments and particularly to devices used to locate and measure the amount of unbalance which can be mounted on the shaft or mandrel of the object to be balanced.

An object of my invention is to decrease the time necessary to balance an object by providing an attachment for balancing machines which have no so-called balancing head, the said attachment to be mounted on the shaft of the object to be balanced. This attachment is so arranged that an artificial unbalance of varying amount and at various angular displacements can be maintained, controlled and adjusted while the object to be balanced is rotating. Thus by proper manipulation, the amount and angular location of the artificial unbalance may be made to exactly counter-balance the original unbalanced mass.

Another object of my invention is to provide an improved balancing mechanism of the type employing a movable element which is adjustable during the rotation of the object to be balanced in order to determine the location and/or amount of unbalance in said object while it is rotating.

In the accompanying illustrations Fig. 1 shows a side view of the attachment with certain parts shown broken away to reveal details. Fig. 2 shows a plan view of the attachment with portions thereof broken away to form substantially a longitudinal section of the attachment. Fig. 3 is a schematic layout of a conventional balancing machine supporting structure with the balancing attachment mounted on the shaft of the object to be balanced. Fig. 4 shows the schematic diagram of the electric wiring and control equipment.

In Figs. 1, 2 and 3 the clamp or attachment 1 is shown as mounted on the shaft 2 of the object to be balanced. A draw-in collett 3 is provided by means of which the attachment is clamped tightly to the shaft 2 thus causing the entire attachment to revolve with it. Collett 3 carries a sleeve 4 forming a journal or pivotal support for the non-magnetic block 5 which carries two permanent magnets 6 and 6 on which are non-magnetic end pieces 7 and 8. End piece 7 is provided with a recess 9 which forms a bearing for the end of screw 10, the other end of which is held in block 5. Screw 10 carries a motor armature 11 on which is mounted commutator 12. Brush-holder 13 carries brushes which bear on commutator 12. Contact pieces 16 and 17 connected to said brushes are arranged to slide along contact bars 20 and 21 which are secured to magnet 6 but insulated therefrom by insulating strip 19. Conductors 22 and 23 bring electric current from slip-rings 24 and 25 to which leads 26 and 27 supply electric current through brush 28 carried on stationary support or yoke 30. Thus armature 11 constitutes a movable mass, which moves radially toward or away from the center line of shaft 2, the direction depending on the direction of flow of the electric current.

At the other end of the attachment and adjacent to end-piece 8 is a motor armature 32 mounted on shaft 34 which is carried in bearing 35 in end piece 8 and in bearing plate 36. Shaft 34 is mechanically coupled to a flexible shaft 37 which in turn is mechanically coupled to worm 38 engaging a worm gear on or secured to the sleeve 4 as shown. On armature 32 is mounted a commutator 33 on which bear brushes which receive electric current from leads 41 and 42 which are connected to slip rings 43 and 44 on which bear brush 45 carried on stationary yoke 30. Brush 45 is connected to conductors 47 and 48. Thus when electric current is supplied to the leads 47 and 48 the armature 32 rotates in a direction dependent on the direction of flow of electric current, and the angular location of the balance indicating attachment with respect to shaft 2 can be changed while the shaft is rotating.

Figure 3 shows a diagrammatic sketch of a balancing machine with pedestals 49 and 50 flexibly mounted on springs 51 and 52 on base 55, the amount of vibration of the pedestals 49 and 50 being partially controlled by the adjustment of springs 53 and 54. Both pedestals 49 and 50 are arranged so as to be free to vibrate or to be clamped in a fixed position as desired. The removable bar 71 is arranged so that when bar 71 is in the position as shown both pedestals vibrate in unison. When bar 71 is removed either of the pedestals 49 and 50 is free to vibrate or clamped in a fixed position as desired. The arm of pedestal 50 operates a dial micrometer or indicator 58 by means of the arm 59 with fulcrum support shown at 60 while 61 is an adjustable electrical contact device closed by oscillation of the arm 59.

Figure 4 shows the schematic electrical diagram in which armature 11 is shown supplied with electric current from collector rings 24 and 25 which in turn get their current through brushes from conductors 26 and 27 leading from the reversing switch 64 which is connected to battery 70 by lead 69 and also to a manually

operated switch contact 62 which when closed is connected by conductor 68 to battery 70. By reversing switch 64 the direction of current flowing through armature 11 is reversed and the direction of rotation is reversed. Thus the direction of rotation and amount of rotation of armature 11 can be readily controlled while attachment 1 revolves with shaft 2. Contact 61 makes momentary contact with each vibration of the pedestal 50 to effect automatic operation of the balancing means for approximate compensation, and balancing adjustment also may be made whenever desired by momentarily closing the manually operated contact 62. Similarly armature 32 gets its electric current from conductors which are connected to collector rings 43 and 44, on which bear brushes which are connected by conductors 47 and 48 to the reversing switch 65. Switch 65 is connected to switch blade 67 which is manually operated and makes contact with conductor 68 and thus to battery 70. The other pole of the switch 65 is connected to the conductor 69 and thus to the other pole of battery 70.

The operation of the balancing attachment is as follows: The object to be balanced is placed on the balancing machine with the attachment 1 firmly secured to the shaft 2. The armature 11 is moved a short distance from its neutral or balanced position. The machine is then started, the belt 56 causing the object to be balanced to rotate. The bar 71 being in place, the two pedestals 49 and 50 vibrate in unison and the indicator 58 shows the amount of vibration or swing. The switch 67 is now closed with the reversing switch 65 in the top position. If the indicator reading increases as the switch 61 is periodically closed by the vibration of the pedestal 50, switch 67 is opened and the reversing switch 65 thrown to the lower position and the switch 67 closed again. The indicator reading should now decrease and switch 67 is kept closed until a minimum reading is reachced when switch 67 is opened. The location of the attachment 1 now shows the angular position of the unbalanced mass. Now with the reversing switch 64 closed in the top position switch 62 is closed momentarily. If the indicator reading increases the reversing switch 64 is thrown to the lower position and switch 62 closed again. The reading of the indicator should now show a decreasing amount until the zero point is reached when the switch 62 is opened. The distance the armature 11 has moved from its neutral position multiplied by its weight in ounces gives the amount of unbalance of the original and the center line of attachment 1 gives the angular location of the unbalance. The above is, of course, for the correction of static unbalance and the same procedure with bar 71 removed and pedestal 49 secured in a fixed position will locate the dynamic unbalance taking into account the distances from the center line of pedestal 50 to center line of attachment 1 and also from pedestal 50 to the vertical plane where the correction can be made.

What I claim is:

1. In a balancing machine, the combination of a supporting means for rotatively supporting an object to be balanced and a frame arranged to rotate with said object, adjustable weights mounted in the frame, one of said weights comprising an electric motor having its rotor arranged to move along a path at an angle to the axis of said object when the motor is energized, the other of said weights comprising a second electric motor arranged to move the frame angularly about the axis of said object when it is energized.

2. The combination of a balancing machine and an electrically operated balancing mechanism or attachment mounted on the shaft of the object to be balanced, said mechanism including an electric motor comprising a rotatable armature having its axis disposed radially of said shaft, said armature being so constructed and arranged as to be movable along its axis, and means for energizing the motor while the object is rotating to vary the position of said armature with respect to the shaft.

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