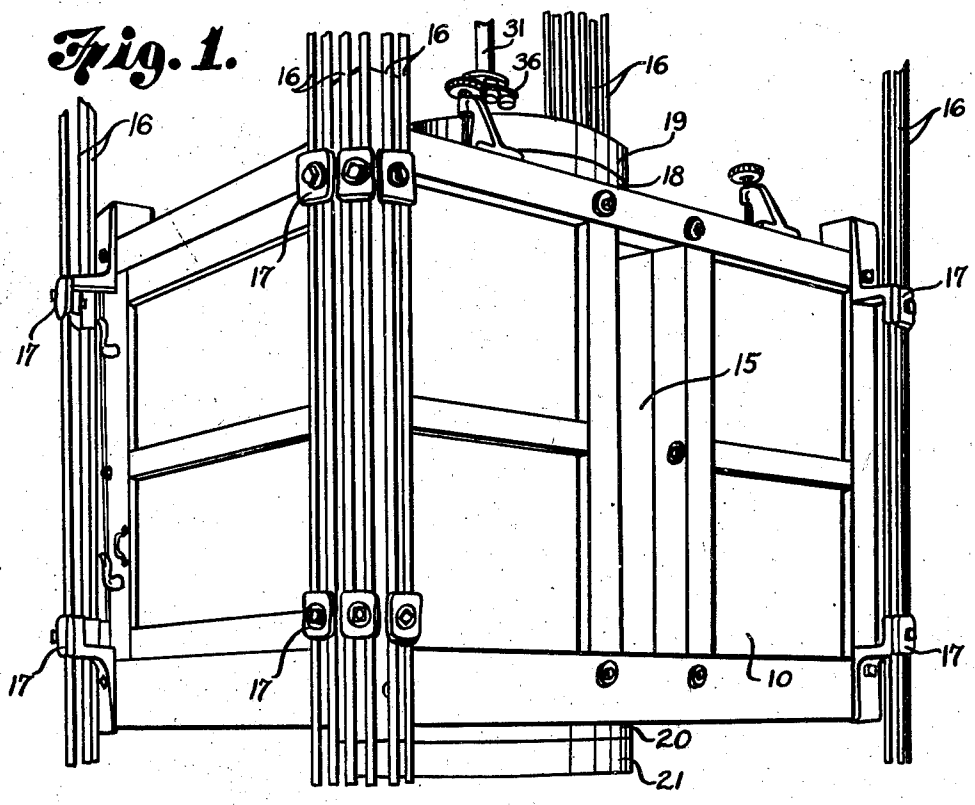
April 24, 1945. W. E. NORVELL 2,374,451

BOLTER DRIVE

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Fig. 1.



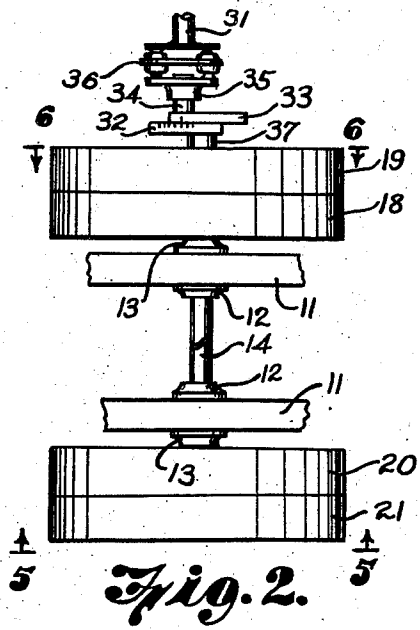


Fig. 2.

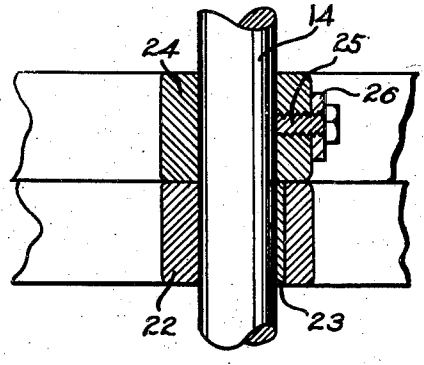


Fig. 3.

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Fig. 4.

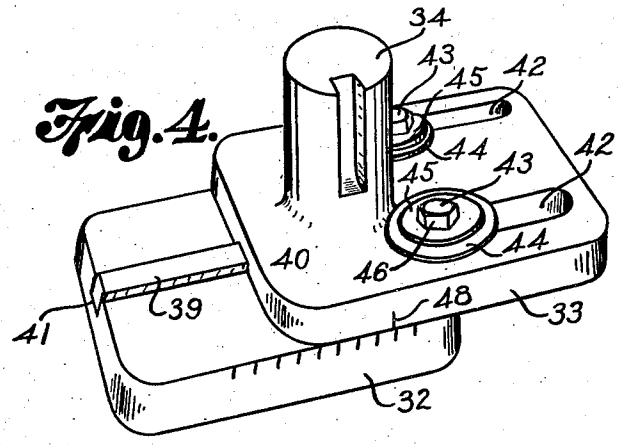


Fig. 5.

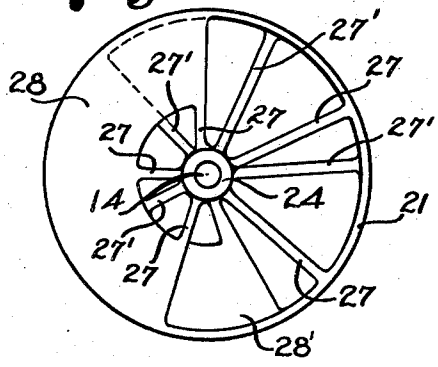


Fig. 6.

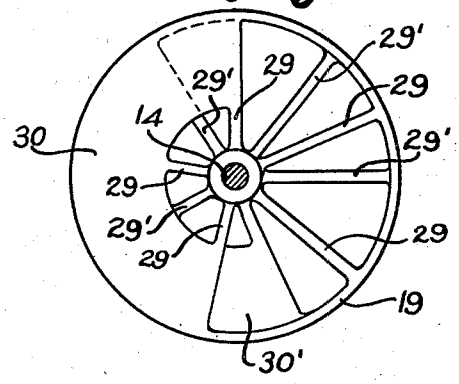
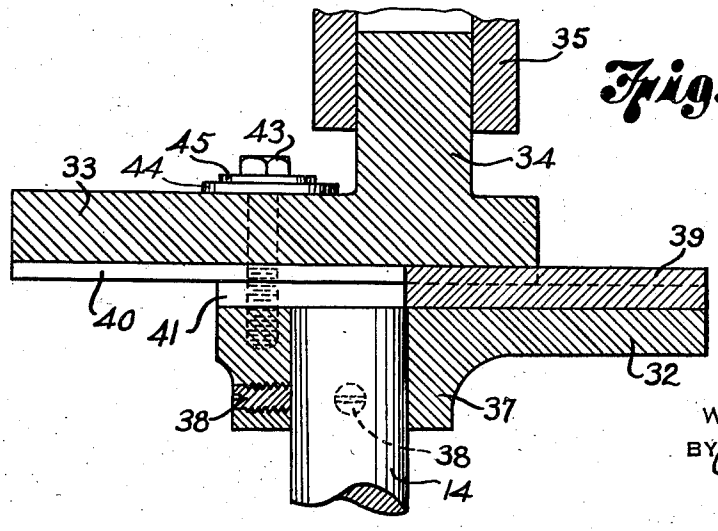


Fig. 7.



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UNITED STATES PATENT OFFICE

2,374,451

BOLTER DRIVE

William E. Norvell, Kansas City, Mo.

Application March 8, 1943, Serial No. 478,481

13 Claims. (Cl. 209—366.5)

My invention relates to bolters, and more particularly to a drive for bolters.

In flour sifters or bolters, it is desirable to provide a gyratory motion to the bolter body containing the sieves. This gyratory motion should vary in rate as well as in radius of gyration for different materials that are to be separated by the bolter. It is desirable that the radius of gyration be capable of very fine and accurate adjustment to get the desired bolting action for the particular material that is to be acted on by the bolter, and it is desirable that the motion that is produced by the means moving the bolter to produce the sifting action be a true gyratory motion.

It is an important purpose of my invention to provide new and improved means for producing a gyratory motion in a bolter that is readily adjustable so as to produce a gyration of the bolter of any desired radius, and which is readily adjustable to that radius and which can be very closely and accurately adjusted to obtain the radius of gyration desired.

It is a particular purpose to obtain the desired gyratory motion by means of eccentrically mounted rotatable weights, which after having been set into motion and after having attained their desired rate of rotation, set up a gyratory motion of the desired radius of gyration of the bolter, said eccentrically arranged weights being, preferably, made up of means located adjacent the top of the bolter and means located adjacent the bottom of the bolter and rotating about a common axis, so that the eccentrically mounted weight above the top of the bolter and the eccentrically mounted weight below the bottom of the bolter will counterbalance each other so that the operation of the bolter will be a truly balanced operation.

Specifically, my improved adjustable means for providing rotatable means above and below the body portion of the bolter, the center of mass of which is adjustable relative to the center of rotation thereof, comprises a pair of rotatable members, which are, preferably, of a wheel-like character, and which are each provided with a weight that is mounted eccentrically to the axis of rotation of said members, which are relatively adjustable to vary the position of said eccentrically mounted weights relative to each other, to thus adjust the centers of mass of said rotatable members relative to each other, whereby very fine adjustment of the location of the center of mass of each of said pair of members relative to the axis of rotation can be obtained.

Preferably, each of said rotatable wheel-like members is provided with a weight spaced from the axis of rotation thereof, which has the same mass as that of the weights provided on the other wheel-like rotatable members, and the adjustment of the center of mass is obtained by rotating one member of each pair about the axis of rotation relative to the other member of each pair, one of the members of each pair being fixed on the shaft carrying said members so as to not be adjustable therearound, and the other member of each pair being secured to the shaft in a manner that the same can be adjusted to any position desired around the axis of the shaft. Preferably, the pair of members above and the pair of members below the bolter body are adjusted to the same relative position so as to balance the eccentricity of the weight, or center of mass, located above and below the bolter, thus avoiding any stress on the bolter itself or its mountings due to the provision of said eccentric means.

It is another important purpose of my invention to provide new and improved means for driving a bolter so that the same has a gyratory motion, comprising a drive shaft, which is aligned substantially with the axis of gyration of the bolter body, and which drives the shaft mounted on the bolter carrying the rotatable wheel-like members through a crank member, said crank member being adjustable so that the length thereof can be made exactly that of the radius of gyration, so that the drive shaft will lie truly on the axis of gyration. By this arrangement, no undesirable stresses will be placed on the drive shaft, and while it is necessary to provide a universal driving connection between the drive shaft and said crank means, in order that the gyration of the device can be started, after the device attains its desired speed, the universal joint is inoperative, in that the shaft portion on one side thereof is in true axial alignment with the shaft portion on the other side thereof, and the coupling that is the universal joint acts merely as an ordinary shaft coupling after the speed of gyration desired has been attained, with the crank properly adjusted so that the length of the crank arm will be the same as the radius of gyration of the bolter.

Other objects and advantages of my invention will appear as the description of the drawings proceeds. I desire to have it understood, however, that I do not intend to limit myself to the particular details shown or described, except as defined in the claims.

In the drawings:

Fig. 1 is a perspective view of a bolter to which my improved driving means is applied, the supporting means for the bolter and the drive shaft being partly broken away.

Fig. 2 is an elevation of the bolter driving means producing the gyratory motion, the gyratory shaft being partly broken away and only fragments of the bolter body being shown.

Fig. 3 is a fragmentary enlarged view partly in section and partly in elevation, showing the mounting of a pair of the wheel-like members on the gyratory shaft.

Fig. 4 is a perspective view of the adjustable crank member forming part of my invention.

Fig. 5 is a bottom plan view taken substantially on the line 5—5 of Fig. 2 on a slightly enlarged scale.

Fig. 6 is a section taken on the line 6—6 of Fig. 2 on a slightly enlarged scale, and

Fig. 7 is a vertical sectional view through the adjustable crank member forming part of my drive.

Referring in detail to the drawings, my bolter comprises a body portion 10, which may be of conventional construction as far as its general arrangement is concerned, and which, of course, contains the sieves that are usually provided in the bolter. Said body portion may be provided with a frame that has a plurality of members running in various directions, such as the members 11, upon which the bearings 12 and 13 for the shaft 14 are mounted. Said shaft 14 extends vertically of the bolter body between the two sections thereof lying in the space 15 provided between said bolter body sections, so as to be located substantially centrally of said bolter body. The bolter body is, preferably, mounted so as to be capable of a gyratory motion, this being preferably accomplished by means of a plurality of wooden reeds 16, which are provided substantially at the corners of the bolter body, being securely fastened thereto by any suitable means, such as the clamps 17. It is customary to mount said reeds on a suitable support above the bolter body, (not shown), in a similar manner to that shown for securing the same to the bolter body, so that said bolter body is suspended from said reeds 16, which will flex readily to permit the gyratory motion that is desired of said bolter, but will constrain said motion within desired limits.

The shaft 14 has mounted thereon a pair of wheel-like members 18 and 19 adjacent the top of the body 10 and a pair of wheel-like members 20 and 21 adjacent the bottom of said bolter body 10. Each of the wheel-like members is of a similar character, and one wheel-like member of each pair is a duplicate of a wheel-like member of the other pair. In the arrangement shown, the wheel-like members 18 and 20 are duplicates, and the wheel-like members 19 and 21 are duplicates. Each of said wheel-like members 20 and 18 are provided with a hub portion 22, which is provided with a key-way cooperating with a similar key-way in the shaft 14 to secure the wheel-like members 18 and 20 in fixed position on said shaft 14 by means of a key 23. Each of the wheel-like members 19 and 21 is provided with a hub portion 24, which is provided with a set screw 25 engaging the shaft 14 for clamping said wheel-like members 19 and 21 in position on said shaft, so as to rotate therewith, said wheel-like members being, however, adjustable around said shaft, as will be obvious. A washer 26 may be provided between the head of the set screw and the hub portion 24, if desired.

Referring to Figs. 5 and 6, it will be noted that the wheel-like member 21 is provided with a plurality of spokes 27 extending from the hub to the rim thereof, and that a weight 28, similar to a counterweight, is provided between certain of said spokes 27, said weight 28 lying at a spaced point from the hub 24 and extending from the rim of said wheel-like member 21 inwardly a uniform distance, so as to form a weight of a given mass having its center of mass at a certain definitely spaced distance from the axis of the shaft 14. The wheel-like member 20, as far as its construction otherwise than at the hub is concerned, is a duplicate of the wheel-like member 21, having spokes 27', similar to the spokes 27, and having a counterweight portion 28' that is a duplicate in size, location and mass relative to the axial center of the wheel, of the weight member 28. The wheel-like member 19 is provided with spokes 29 and with a weight 30 extending inwardly from the rim thereof, which is similar in all respects to the weight 28 provided on the wheel-like member 21 and is, preferably, of the same mass and similarly located relative to the axis of the shaft 14 as said weight 28. Also the wheel-like member 18 is provided with spokes 29', similar to the spokes 29, and with a weight 30' that corresponds in size, location and mass to the weight 30 of the wheel-like member 19.

It will be obvious that the unbalanced condition of the rotating system made up of the wheel-like members 18 and 19, and the rotating system made up of the wheel-like members 20 and 21 can be varied between a maximum, with the weight-like members 28 and 28', and the weight-like members 30 and 30' in axial alignment with each other and a minimum, with the weight-like members 28 and 28' diametrically opposite each other, and the weight-like members 30 and 30' diametrically opposite each other. When said weight-like members 28 and 28', and 30 and 30', are diametrically opposite each other there will be no gyration of the body member 10 and any degree of adjustment of the amount of gyration between the maximum obtainable in the manner above referred to, and this minimum, or zero, gyration can be obtained by adjusting the wheel-like members 19 and 21 relative to the wheel-like members 18 and 20 to get any desired relative position of the weights 28 and 28' and 30 and 30' about the axis of rotation of the shaft 14. Obviously a very fine adjustment of the gyratory movement of the bolter body 10 can be obtained in this manner, and if the upper pair of members 18 and 19 and lower pair of members 20 and 21 are carefully adjusted so that the relative position of the members 18 and 19 and of the members 20 and 21 is substantially the same, the unbalanced weight creating the gyration will be the same above and below said body, thus avoiding all stresses due to a lack of balance between the weight above and below the bolter body and producing a true gyratory motion about a center or axis that is parallel to the drive shaft to be described below.

The shaft 14, with which the weighted members rotate, is driven from the drive shaft 31, which may be mounted in bearings in any desired manner, so as to extend vertically downwardly from above the bolter, through a driving means made up of a pair of relatively adjustable members 32 and 33. The member 33 is provided with an upwardly extending stub shaft portion 34,

which is keyed in a socket member 35 provided on the universal joint 36, which serves to couple said shaft 31 with the stub shaft 34. The member 32 is provided with a depending socket member 37, in which the upper end portion of the shaft 14 is fixed by means of a plurality of set screws 38. The members 32 and 33 are secured together so as to be longitudinally slidable relative to each other and are constrained to a path in the adjustment thereof parallel to the length thereof by means of a key 39, which is mounted slidably in the groove 40 in the member 33, and is fixed in position in the groove 41 in the member 32. The member 33 is provided with a pair of parallel longitudinally extending slots 42, through which the bolts 43 extend, which are mounted in openings in the member 32. Washers 44 and 45 are provided between the nuts 46 on the bolts 43 and the top face of the member 33. The members 32 and 33 are adjusted by sliding the members 32 and 33 relatively upon loosening of the nuts 46 to relieve the clamping pressure exerted by the bolts 43 and said nuts 46, and after adjustment to desired position, said nuts 46 are tightened to clamp the members 32 and 33 in fixed position relative to each other.

It will thus be seen that the shaft members 31 and 14 are connected with each other by means of the universal joint 36 and the adjustable crank made up of the members 32 and 33, so that the shaft 14 will travel in a circular orbit around the shaft 31 as an axis and will also rotate on its own axis. The members 32 and 33 are adjusted so as to provide a spacing between the axis of the stub shaft 34 and the axis of the shaft 14 that is the same as the radius of gyration of the body member 10 after the apparatus has reached its normal speed of operation. The shaft 31 can be driven at various speeds through any suitable driving means to get various rates of rotation for said shaft 31 and the shaft 14. While a certain type of universal joint is shown at 36, any suitable type of joint can be provided for providing a universal or flexible driving connection between the shaft 31 and the stub shaft 34. Such flexible or universal driving connection is necessary due to the fact that when the bolter is first set in operation, the shaft 31 and the stub shaft 34 will not be in axial alignment because the gyratory movement of the bolter has not yet been established. After the gyratory movement of the bolter body 10 has been established the driving connection 36 is inoperative except as a coupling, inasmuch as the adjustment of the members 32 and 33 is such that said stub shaft 34 and the shaft 31 will be in exact axial alignment.

This axial alignment of the shafts 34 and 31 can be accomplished due to the fact that the shaft 14 will travel in a path parallel to the shaft 31 about the shaft portion 34 as a center when the gyration of the bolter body 10 has been established, provided the members 32 and 33 are so adjusted that the axis of the shaft 34 and the axis of the socket 37, which corresponds to the axis of the shaft 14, are spaced the radius of gyration apart.

In operation the members 18 and 19, and 20 and 21, are adjusted so as to obtain the gyratory motion of the bolter desired. This can be established originally by trial, but will ordinarily be the same for the bolting of a particular material. After the members 18 and 19 and 20 and 21 have been relatively adjusted by adjusting the members 19 and 21 about the shaft 14 to get the desired relative position of the weights carried by said members to the weights carried by the members 18 and 20, said members 19 and 21 are fixed to the shaft 14 by tightening up the set screws 25. The bolter 10 is then started in operation by setting the drive shaft 31 in motion. After the speed of the drive has been fully established and the bolter 10 has settled down to a steady gyratory movement, the circular path of such gyratory motion can be established by merely placing a piece of paper, or anything else that can be marked upon, on the top of the bolter body 10 and a pencil or other marking means can be held in a fixed position against said paper, whereupon a circle of the diameter of the gyratory motion of the bolter will be drawn on the paper by means of the pencil. This can be measured and the spacing of the axes of the shafts 34 and 14 can be made equal to the radius of such circle by proper adjustment of the members 32 and 33 relative to each other. Of course, this is, preferably, done by stopping the bolter and adjusting the members 32 and 33 relative to each other, tightening up the clamping means holding said plate-like members 32 and 33 in adjusted position, and then setting the bolter in operation again. After this has been done and the bolter is established in steady gyratory operation, the axis of the shaft 34 and that of the shaft 31 will coincide. Thus the universal joint 36 will act as such only until the gyration of the bolter body 10 is fully established, after which it only acts as an ordinary coupling.

The adjustment of the members 32 and 33 relative to each other is, preferably, accomplished by means of a scale 47 on the flat side face of the member 32 adjacent the upper surface thereof, which cooperates with a single index 48, provided on the side face of the member 33 adjacent its bottom face, which is in transverse alignment with the axis of the shaft 34. Any suitable indicia can be provided on the scale 47, which can either read directly in inches or fractions thereof, which would necessitate dividing the diameter of the circle drawn to determine the orbit of the gyrations of the shaft 14 by two to determine the radius of gyration, or the scale can be made to read directly in the diameter of the orbit of gyrations of the shaft 14. Because the members 18 and 19, and 20 and 21 are duplicate adjustable off-center weight devices, located at substantially a uniform distance above and below the bolter body 10, the gyration set up by the unbalanced weight of these devices will cause the shaft 14 to gyrate in a path such that its axis will always be vertical and thus always parallel to the shaft 31. This makes it possible to align the axis of the stub shaft 34 with the axis of the shaft 31 by means of the adjustable crank made up of the members 32 and 33, as above described.

What I claim is:

1. In a bolter, a flexibly mounted body portion, a vertical drive shaft and means mounted on said body portion and flexibly suspended from the lower end of said drive shaft for producing a gyratory motion of said body portion, comprising rotatable means above and below said body portion, each of said rotatable means comprising a pair of rotatable members, and means connected with said drive shaft for rotating the same about a common substantially vertical axis, each of said rotatable members having its center of mass eccentric to its center of rotation, said members being relatively adjustable about the center of rotation thereof to adjust the centers of mass thereof to any desired position relative to each other

to adjust the center of mass of each of said rotatable means relative to is center of rotation.

2. In a bolter, a flexibly mounted body portion and means for producing a gyratory motion thereof, comprising rotatable means above and below said body portion, each of said rotatable means having its center of mass adjustable relative to its center of rotation, and means for rotating said rotatable means comprising a drive shaft, a shaft upon which said rotatable means are mounted, and a crank of adjustable throw connecting said shafts.

3. In a bolter, a flexibly mounted body portion and means for producing a gyratory motion thereof, comprising rotatable means above and below said body portion, each of said rotatable means having its center of mass adjustable relative to its center of rotation, and means for rotating said rotatable means comprising a drive shaft, a shaft upon which said rotatable means are mounted, and a crank connecting said shafts, said crank being adjustable to obtain a throw thereof equal to the radius of gyration of said body portion.

4. In a bolter, a flexibly mounted body portion and means for producing a gyratory motion thereof, comprising a pair of rotatable members, and means for rotating the same about a common axis comprising a drive shaft, a shaft upon which said rotatable means are mounted, and a crank of adjustable throw connecting said shafts, each of said rotatable members having its center of mass eccentric to its center of rotation, said members being relatively adjustable to adjust the centers of mass thereof relative to each other.

5. In a bolter, a flexibly mounted body portion and means for producing a gyratory motion thereof, comprising rotatable means above and below said body portion, each of said rotatable means comprising a pair of rotatable members, and means for rotating the same about a common axis comprising a drive shaft, a shaft upon which said rotatable means are mounted, and a crank of adjustable throw connecting said shafts, each of said rotatable members having its center of mass eccentric to its center of rotation, said members being relatively adjustable to adjust the centers of mass thereof relative to each other to adjust the center of mass of each of said rotatable means relative to its center of rotation.

6. In a bolter, a drive shaft, a bolter body, flexible means for suspending the same, a gyratory shaft mounted for rotation on said body, an adjustable crank connecting said shafts, and rotatable means on said gyratory shaft above and below said body portion, each of said rotatable means having its center of mass adjustable relative to the axis of rotation of said gyratory shaft.

7. In a bolter, a drive shaft, a bolter body, flexible means for suspending the same, a gyratory shaft mounted for rotation on said body, an adjustable crank connecting said shafts, and rotatable means on said gyratory shaft above and below said body portion, each of said rotatable means having its center of mass adjustable relative to the axis of rotation of said gyratory shaft, comprising a pair of fly wheels each comprising a weight eccentrically mounted relative to the axis of rotation thereof, the fly wheels of each pair being relatively adjustable about the axis of said shaft to shift the position of said weights relatively to each other.

8. In a bolter, a bolter body, flexible means for suspending the same to permit gyration thereof, a shaft mounted to rotate in bearings on said bolter body, a pair of wheel-like members mounted on said shaft adjacent the top of said body and a pair of wheel-like members mounted on said shaft adjacent the bottom of said body, each of said members being provided with a weight mounted eccentrically of said shaft, one of said members of each pair being mounted in fixed position on said shaft and the other member of each pair being adjustable around said shaft, to adjust the relative position of said weights, and means for rotating said shaft to cause said bolter body to gyrate.

9. In a bolter, a bolter body, flexible means for suspending the same to permit gyration thereof, a shaft mounted to rotate in bearings on said bolter body, a pair of wheel-like members mounted on said shaft adjacent the top of said body and a pair of wheel-like members mounted on said shaft adjacent the bottom of said body, each of said members being provided with a weight mounted eccentrically of said shaft, one of said members of each pair being mounted in fixed position on said shaft and the other member of each pair being adjustable around said shaft, to adjust the relative position of said weights, a crank comprising a pair of longitudinally adjustable members, one of said members being fixed to said shaft, and the other of said members having a stub shaft projecting therefrom, a drive shaft and a universal joint connecting said drive shaft and said stub shaft.

10. In a bolter, a bolter body, flexible means for suspending the same to permit gyration thereof, a shaft mounted to rotate in bearings on said bolter body, a pair of wheel-like members mounted on said shaft adjacent the top of said body and a pair of wheel-like members mounted on said shaft adjacent the bottom of said body, each of said members being provided with a weight mounted eccentrically of said shaft, one of said members of each pair being mounted in fixed position on said shaft and the other member of each pair being adjustable around said shaft to adjust the relative position of said weights, a crank comprising a pair of longitudinally adjustable members having interfitting tongue and groove portions slidably engaging, one of said members being fixed to said shaft, and the other of said members having a stub shaft projecting therefrom, a drive shaft and a universal joint connecting said drive shaft and said stub shaft.

11. In a bolter, a bolter body, flexible means for suspending the same to permit gyration thereof, a shaft mounted to rotate in bearings on said bolter body about a substantially vertical axis, a pair of wheel-like members mounted on said shaft adjacent the top of said body and a pair of wheel-like members mounted on said shaft adjacent the bottom of said body, each of said members being provided with a weight mounted eccentrically of said shaft, the weights on each of said members being of substantially the same mass and shape and mounted the same distance from the center of rotation of the wheel-like member on which it is provided, one of said members of each pair being mounted in fixed position on said shaft and the other member of each pair being rotatable around said shaft to adjust the same to any position around said shaft, to adjust the relative position of said weights, means for fixing said rotatable member to said shaft for any position thereof and means for rotating said shaft to cause said bolter body to gyrate, comprising a vertical drive shaft and a universal joint connecting said first mentioned shaft and the lower end of said drive shaft to suspend said first shaft

therefrom for freedom of movement with said body.

12. In a bolter, a bolter body, flexible means for suspending the same to permit gyration thereof, a shaft mounted to rotate in bearings on said bolter body, a pair of wheel-like members mounted on said shaft adjacent the top of said body and a pair of wheel-like members mounted on said shaft adjacent the bottom of said body, each of said members being provided with a weight mounted eccentrically of said shaft, the weights on each of said members being of substantially the same mass and shape and mounted the same distance from the center of rotation of the wheel-like member on which it is provided, one of said members of each pair being mounted in fixed position on said shaft and the other member of each pair being adjustable around said shaft to adjust the relative position of said weights, a crank comprising a pair of longitudinally adjustable members, one of said members being fixed to said shaft, and the other of said members having a stub shaft projecting therefrom, a drive shaft and a universal joint connecting said drive shaft and said stub shaft.

13. In a bolter, a bolter body, flexible means for suspending the same to permit gyration thereof, a shaft mounted to rotate in bearings on said bolter body, a pair of wheel-like members mounted on said shaft adjacent the top of said body and a pair of wheel-like members mounted on said shaft adjacent the bottom of said body, each of said members being provided with a weight mounted eccentrically of said shaft, the weights on each of said members being of substantially the same mass and shape and mounted the same distance from the center of rotation of the wheel-like member on which it is provided, one of said members of each pair being mounted in fixed position on said shaft and the other member of each pair being adjustable around the shaft, to adjust the relative position of said weights, a crank comprising a pair of longitudinally adjustable members having interfitting tongue and groove portions slidably engaging, one of said members being fixed to said shaft, and the other of said members having a stub shaft projecting therefrom, a drive shaft and a universal joint connecting said drive shaft and said stub shaft, said members being provided with means indicating the spacing of the axes of said shafts extending therefrom and having means for clamping the same in adjusted position.

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