Nov. 20, 1928.

E. E. DROWNS

1,692,769

GRINDING MACHINE

Filed June 23, 1925

2 Sheets-Sheet 1

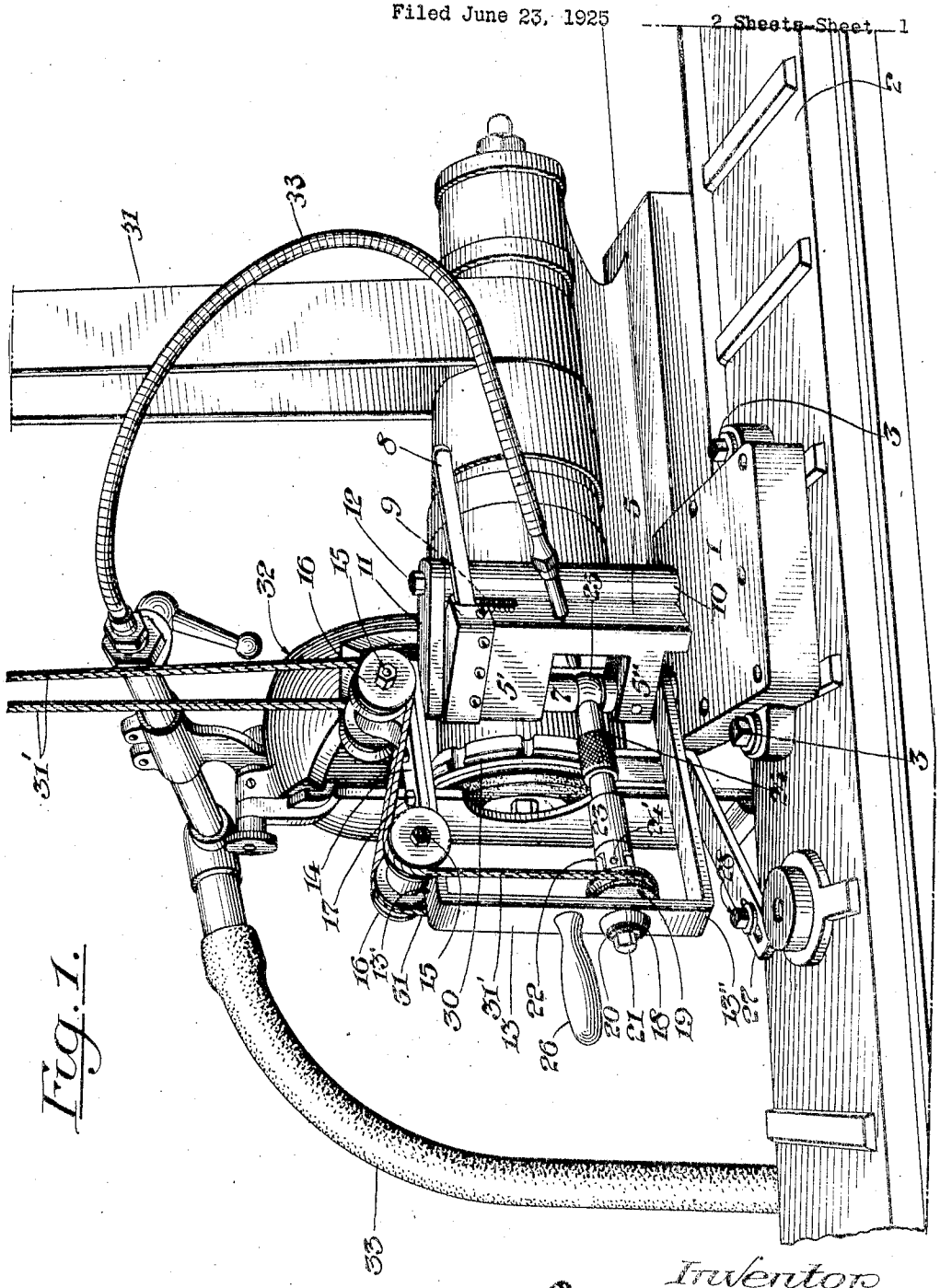


Fig. 1.

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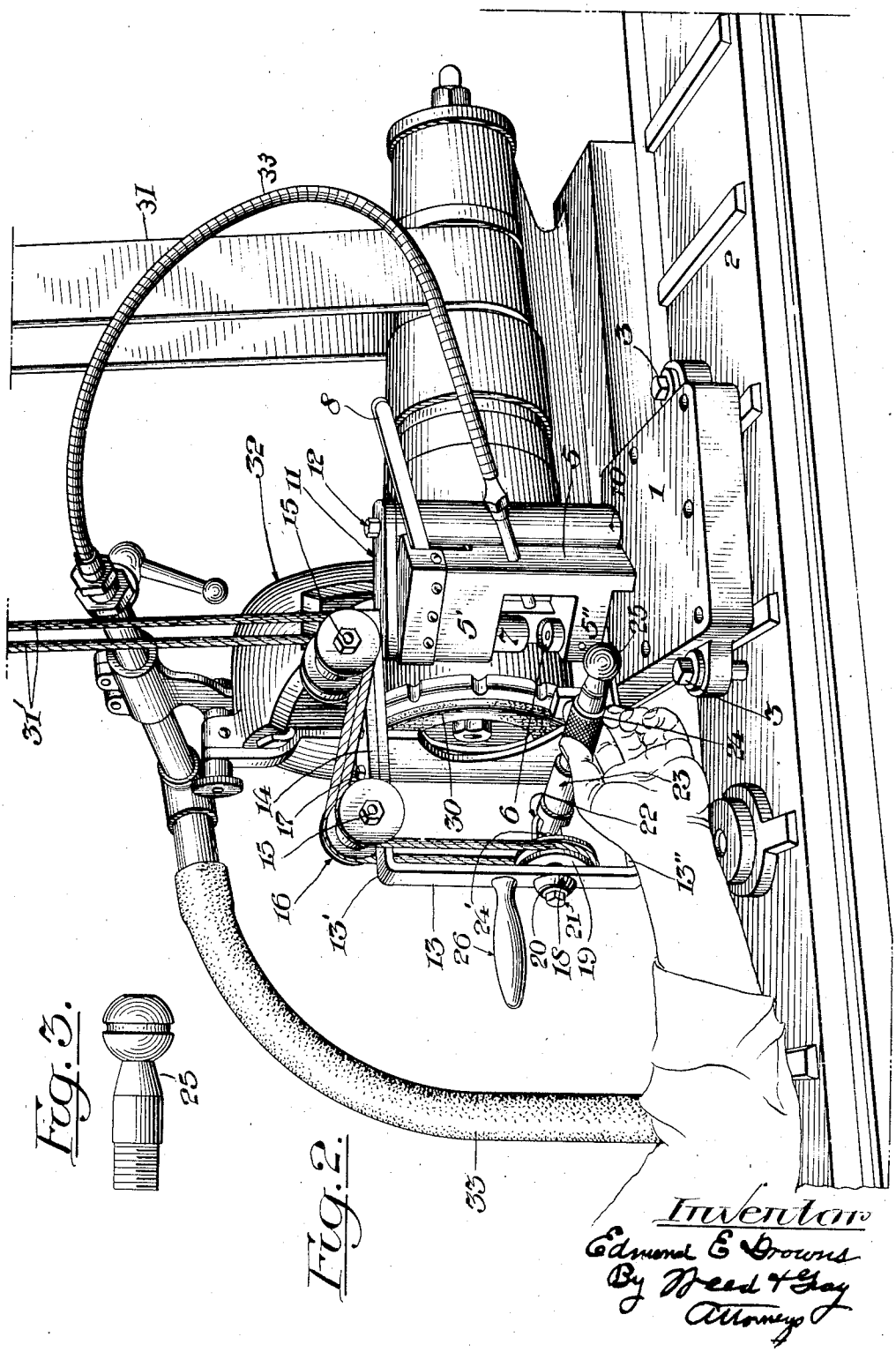


Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

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GRINDING MACHINE.

Application filed June 23, 1925. Serial No. 38,965.

This invention relates to grinding machines, an object of the invention being to provide an improved grinding machine for grinding spherical surfaces, such as ball joints or other pieces requiring a radius.

The object of the invention is the provision of an improved grinding fixture, by means of which the ball portion to be ground is always centered and will therefore be ground a true sphere, and which is simple in construction and comparatively inexpensive to manufacture, and by means of which an increase in production is obtained as compared with other methods heretofore employed, and which can be readily applied to the various types of grinders now manufactured having a revolving grinding wheel.

In the drawings accompanying and forming a part of this specification, Fig. 1 is what may be designated as a front view of this improved fixture; Fig. 2 is a similar view illustrating the work partially removed; and Fig. 3 is a detail view of a piece of work such as a steering arm pin.

Similar characters of reference indicate corresponding parts in the several views.

Before explaining in detail the present improvement and mode of operation thereof, I desire to have it understood that the invention is not limited to the details of construction and arrangement of parts which are illustrated in the accompanying drawings, since the invention is capable of other embodiments, and that the phraseology which I employ is for the purpose of description and not of limitation.

The base 1 of this improved fixture is mounted on the table 2 carried by a suitable supporting frame which also supports a grinding disk or wheel 30 mounted upon a shaft driven in the present instance by a belt 31 from some suitable source of power, this grinding wheel being suitably enclosed in a casing 32 supporting suitable means for conveying a cooling lubricant to the work and shown herein as a hose 33.

This base 1 is secured to the table 2 by suitable screws 3 and this base is provided with an extension or bracket 5 having a pair of spaced arms 5′ and 5″, the lower one of which 5″ is suitably machined to receive a ball seat 6 secured in position by a suitable set screw. The upper arm 5′ of this bracket 5 is suitably machined to receive an upper ball seat 7, which slides up and down in the arm freely, and this ball seat 7 is suitably connected with a lever 8 pivoted to the bracket 5. Located in the bracket 5 is a spring 9 to engage against the lever 8 and hold the same in its raised position. A post 10 is suitably mounted on the base 1 and securely held thereon, and is provided with an arm 11 held in place by a screw 12. This arm 11 is provided with a suitable stud on which the upper portion or arm 13′ of a swinging bracket 13 is pivoted. The lower arm 13″ of this swinging arm 13 is suitably pivoted to the base 1 between the lower bracket arm 5″ and the base 1. A pulley bracket 14 is securely mounted on the top of the upper arm 13′ of the bracket 13, and this pulley bracket is suitably drilled at each end to receive studs 15, each of which carries a set of pulleys 16 held in place by nuts 17. The bracket 13 is suitably drilled and tapped to receive the bushing nut 18, which in turn is drilled to receive the shank of a pulley 19 held in place by a washer 20 and nut 21. Pulley 19 is so located and constructed as to form a part of the universal joint 22 and the shaft 23 of this universal joint is bored to receive a work holder 24. The shank of this holder 24 slides freely in the shaft 23 and is driven thereby through pins 24′ in the shank of the holder, which pins project into elongated slots of the shaft 23.

In the present instance the holder 24 is tapped to receive a piece of work in the form of a ball joint 25, which is to be ground.

It will be understood of course that the holder is suitably designed to receive any work to be ground. In other words, various forms of holders of the general character described may be used according to the work to be ground. By means of the universal joint, the work holder and shaft 23 can be swung away from the bracket 5 for the attachment or detachment of a piece of work to or from the holder, and then swung into position between the ball seats 6 and 7. The pulley 19 connected with the universal joint 22 of the shaft 23 is driven in the present instance by a suitable belt 31′ guided from a suitable independent source of power by the two sets of pulleys 16, although it will be obvious that the shaft 23 may be rotated by other means than the belt, as for instance by a small motor fitted to the top of the bracket 13, so as to revolve the shaft by means of a suitable shaft and bevel gears.

Secured to the bracket 13 is a handle 26. A stop bracket 27 is mounted on the table 2

and securely held thereon by the screw 28, and this stop bracket limits the swinging movement of the bracket 13 so as to prevent it from striking the grinding wheel 30.

Suitable means (not shown) is provided for shifting the table 2 toward the grinding wheel or disk.

In the operation of the present improvement the operator grasps the work holder 24 and swings it into position to permit the piece of work, such for instance as that shown in Fig. 3, to be screwed into the same. The operator then pulls the lever 8 downward, which raises the upper ball seat 7 and the holder 24 with its piece of work 25 is then swung into place so as to carry the ball end of the piece of work between the two ball seats 6 and 7, whereupon the lever 8 is released and the spring thereof forces the same upward, thus forcing the upper ball seat 7 down upon the work, centering the ball of the piece between the upper ball seat and the lower ball seat 6, the spring 9 being sufficiently strong to hold the ball seat 7 against the ball of the piece of work so that the same is held in position for grinding. The operator then starts the rotation of the shaft 23, which causes the work to revolve, this being effected as hereinbefore described, by means of the belt 31'. The grinding wheel and the shaft 23 are rotated by separate drives, which makes it unnecessary to stop the grinding wheel when the tool holder is being loaded or unloaded. While the piece of work 25 is being rotated the table of the grinder is fed toward the grinding wheel, whereupon the grinding wheel starts to grind the piece and the operator, by means of the handle 26, swings the bracket 13 in the desired manner and hence all parts connected with the same, and thus by this means the grinding of the ball portion of the piece is effectively accomplished. Since the ball piece 25 swings and is being revolved at the same time, it is thus ground spherically having centered itself between the two ball seats 6 and 7. By means of the elongated holes in the shaft 23 variation in the shank of the work to be ground is permissible, and this also assists in the centering of the work between the ball seats 6 and 7.

In practice the bracket 13 could be adjustable to correspond to various lengths of work to be handled if desired in case the work is provided with an exceptionally long shank, as by having the arms 13' and 13'' constructed of two telescoping parts. In practice as the grinding wheel is carried by a suitable table which is movable toward and from the work this permits refacing of the wheel.

From the foregoing it will be seen that I have provided a very simple and inexpensive grinding fixture for grinding spherical surfaces in which the grinding wheel may be dressed straight across so that only after a great number of pieces are ground is it necessary to redress the grinding wheel, and in which the wearing of the grinding wheel will not affect the ball portion of the work being ground as to size or as to its spherical formation.

It is to be understood that by describing in detail herein any particular form, structure or arrangement, it is not intended to limit the invention beyond the terms of the several claims or the requirements of the prior art.

Having thus explained the nature of my said invention and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made, or all of the modes of its use, I claim:

1. In a grinding machine having a shiftable table, a grinding wheel, and means for driving it, the combination of supporting means carried by the table, a pair of opposed ball seats carried by said supporting means, one shiftable toward and from the other, a bracket swingable about an axis common to the ball seats, a rotatable shaft carried thereby and having its axis transverse to the axis of the ball seats so as to be capable of occupying a position radial to the axis of the ball seats, means for driving it, and a work holder carried by said shaft for carrying the work in position to be positioned between the ball seats, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats.

2. In a grinding machine having a shiftable table, a grinding wheel, and means for driving it, the combination of supporting means carried by the table, a pair of opposed ball seats carried by said supporting means one shiftable toward and from the other, a bracket swingable about an axis common to the ball seats, a swinging rotatable shaft carried thereby and capable of occupying a position radial to the axis of the ball seats, means for driving it, and a work holder carried by said shaft for carrying the work in position to be positioned between the ball seats, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats, said shaft having a universal joint connection with its driving means.

3. In a grinding machine having a shiftable table, a grinding wheel, and means for driving it, the combination of supporting means carried by the table, a pair of opposed ball seats carried by said supporting means one located above the other and one shiftable toward and from the other, a bracket swingable about an axis common to the ball seats, a rotatable shaft carried thereby and capable of occupying a position radial to the axis of the ball seats, means for driving it, and a work holder car-

ried by said shaft for carrying the work in position to be positioned between the ball seats, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats, said shaft and work holder having a pin and slot connection to permit longitudinal movement of the work holder, thereby to assist in centering the work between the ball seats.

4. In a grinding machine having a shiftable table, a grinding wheel, and means for driving it, the combination of supporting means carried by the table, a pair of opposed ball seats carried by said supporting means, one shiftable toward and from the other, a bracket swingable about an axis common to the ball seats, a rotatable shaft carried thereby and capable of occupying a position radial to the axis of the ball seats, means for driving it, a work holder carried by said shaft for carrying the work in position to be positioned between the ball seats, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats, said shaft having a universal joint connection with its driving means, and said shaft and work holder having a pin and slot connection to permit longitudinal movement of the work holder, thereby to assist in centering the work between the ball seats.

5. In a grinding machine having a shiftable table, a grinding wheel, and means for driving it, the combination of supporting means carried by the table, a pair of opposed ball seats carried by said supporting means, one located above the other and one shiftable toward and from the other, a bracket swingable about an axis common to the ball seats, a rotatable shaft carried thereby and having its axis transverse to the axis of the ball seats so as to be capable of occupying a position radial to the axis of the ball seats, means for driving it, and a work holder carried by said shaft for carrying the work in position to be positioned between the ball seats, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats, said shaft and work holder having a pin and slot connection to permit longitudinal movement of the work holder, thereby to assist in centering the work between the ball seats, the driving means for said shaft being carried by the swinging bracket.

6. In a grinding machine having a grinding wheel, and means for rotating it, the combination of supporting means, a pair of relatively shiftable opposed ball seats carried thereby, a bracket swingable about an axis common to the ball seats, a rotatable universally connected shaft carried by the swinging bracket and having its axis transverse to the axis of the ball seats so as to be capable of occupying a position radial to the axis of the ball seats, means for rotating it, a longitudinal shiftable work holder carried by said shaft, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats, and independent means carried by the swinging bracket for rotating said shaft and work holder.

7. In a grinding machine having a grinding wheel, and means for rotating it, the combination of a pair of opposed ball seats, means for adjusting the same for the reception of the work, a bracket swingable about an axis common to the ball seats, a rotatable shaft carried by said bracket and having its axis transverse to the axis of said ball seats, so as to be capable of occupying a position radial to the axis of the ball seats, means for driving said shaft, and a work holder carried by said shaft, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats.

8. In a grinding machine having a grinding wheel and means for rotating it, the combination of a pair of opposed ball seats for the reception of the work, a swingable and rotatable shaft mounted to swing about an axis common to the ball seats and having its axis transverse to the axis of said ball seats so as to be capable of occupying a position radial to said axis of the ball seats, means for driving said shaft, and a work holder carried by said shaft, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats.

9. In a grinding machine having a grinding wheel and means for rotating it, the combination of a pair of opposed ball seats for the reception of the work, a bracket pivotally connected in alinement with the axis of the ball seats, and swingable about an axis common to said ball seats, a rotatable shaft carried by said bracket and having its axis transverse to the axis of the ball seats so as to be capable of occupying a position radial to the axis of the ball seats, means for driving said shaft, and a work holder carried by said shaft, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats

10. In a grinding machine having a grinding wheel and means for rotating it, the combination of a pair of opposed ball seats for the reception of the work, a swingable and rotatable shaft swingable about an axis common to the ball seats and having its axis transverse to the axis of said seats so as to be capable of occupying a position radial to said axis of the ball seats, means for driving said shaft independently of the grinding wheel, and a work holder carried by said shaft, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats.

11. In a grinding machine having a grinding wheel and means for rotating it, the combination of a pair of opposed ball seats for the reception of the work, a bracket swingable about an axis common to the ball seats, stop means for limiting the movement of said bracket, a rotatable shaft carried by said bracket and having its axis transverse to the axis of the ball seats so as to be capable of occupying a position radial to the axis of the ball seats, means for driving it and a work holder carried by said shaft for engaging the work in position to be positioned between the ball seats, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats.

12. In a grinding machine having a grinding wheel and means for rotating it, the combination of a pair of opposed alined ball seats separable for the insertion of stem formed spherical work, means for supporting said ball seats in a stationary position, a bracket swingable about an axis common to the ball seats, and a rotatable work carrying shaft having its axis transverse to the axis of the ball seats so as to be capable of occupying a position radial to the axis of the ball seats and supported for shiftable movement toward and from the ball seats for loading and unloading the work, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats.

13. In a grinding machine having a grinding wheel, and means for rotating it, the combination of a pair of opposed ball seats, means for adjusting the same for the reception of the work, a bracket swingable about an axis common to the ball seats, a rotatable shaft carried by said bracket and having its axis transverse to the axis of said ball seats, so as to be capable of occupying a position radial to the axis of the ball seats, means for driving said shaft, and a longitudinally adjustable work holder carried by said shaft, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats.

14. In a grinding machine having a grinding wheel and means for rotating it, the combination of a sliding table, a fixed supporting means, carried thereby, a pair of opposed alined ball seats carried by said fixed supporting means and separable for the insertion of stem formed spherical work, a bracket swingable about an axis common to the ball seats and pivotally connected in alinement with the axis of said ball seats, and a rotatable swingingly supported work carrying shaft having its axis transverse to the axis of the ball seats so as to be capable of occupying a position radial to the axis of the ball seats, and shiftable toward and from the ball seats for loading and unloading the work, the relation of the parts being such that the spherical portion of the work may be steadied by said ball seats but rotate with the shaft therebetween and also given an angular movement about the axis of said seats.

15. In a grinding machine having a grinding wheel, and means for rotating it, the combination of a fixed bracket, a pair of ball seats carried thereby, one shiftable toward and from the other, means for moving the ball seats toward the grinding wheel, a swinging bracket, a rotatable shaft carried thereby for the reception of a work holder, driving means for rotating said shaft independently of the grinding wheel and carried by said swinging bracket, said shaft having a swinging connection with the bracket, and said work holder having a lengthwise adjustable connection with the shaft.

16. In a grinding machine having a sliding table, a grinding wheel, and means for rotating it, the combination of a fixture base secured to the table, an upright bracket secured to said base, a pair of spaced ball seats carried by the bracket, one shiftable toward and from the other, a swinging bracket pivotally supported on the base and upright bracket in alinement with the axes of the ball seats and having a handle, a swingingly connected shaft carried by the swinging bracket, means carried by the swinging bracket for rotating said shaft, and a longitudinally adjustable work holder carried by the shaft.

Signed at Cleveland, Ohio, this 15th day of June, 1925.

EDMOND E. DROWNS.