June 5, 1928.

1,671,994

R. G. NELSON

METAL SPINNING APPARATUS

Filed Sept. 9, 1926

3 Sheets-Sheet 1

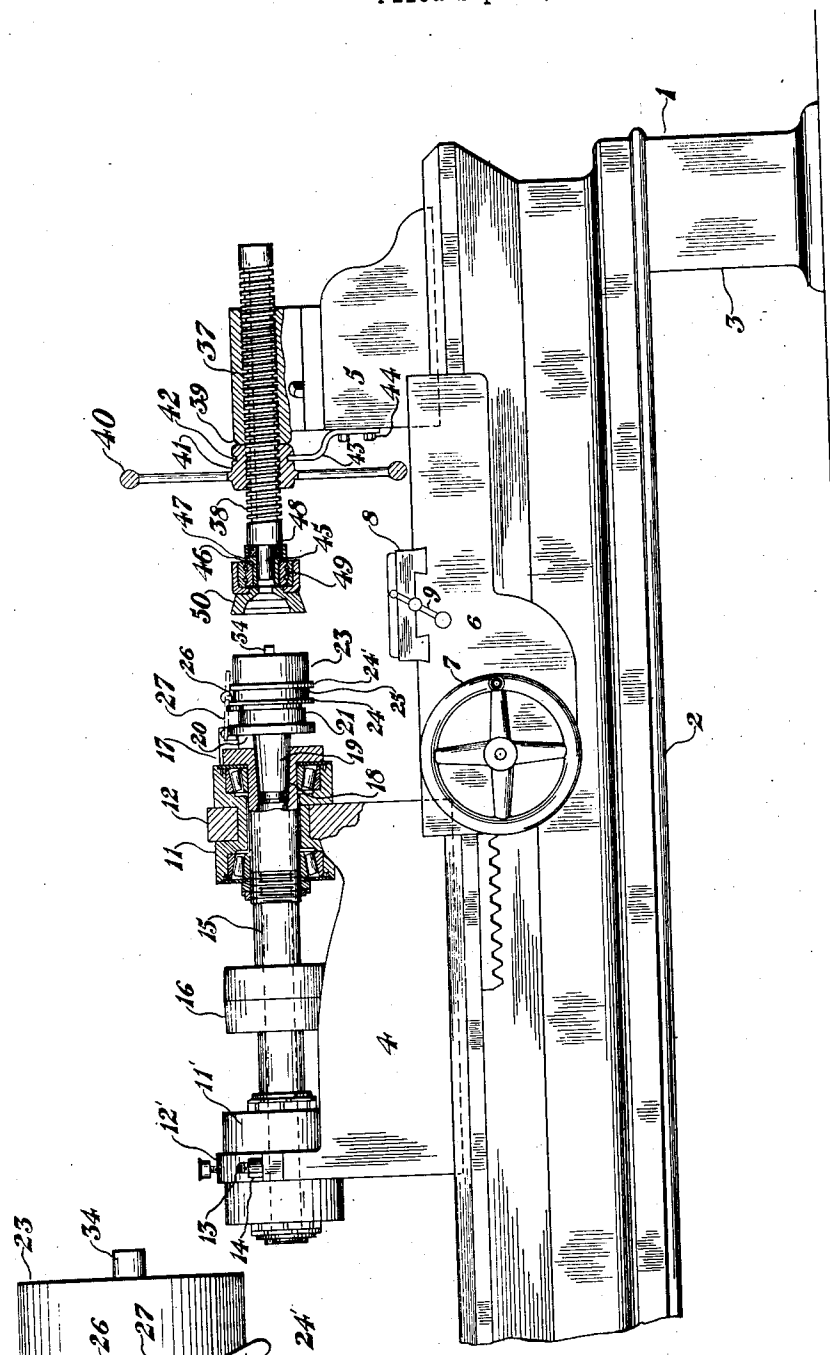


Fig. 1

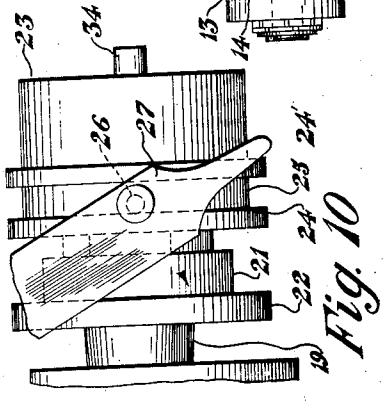


Fig. 10

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3 Sheets-Sheet 2

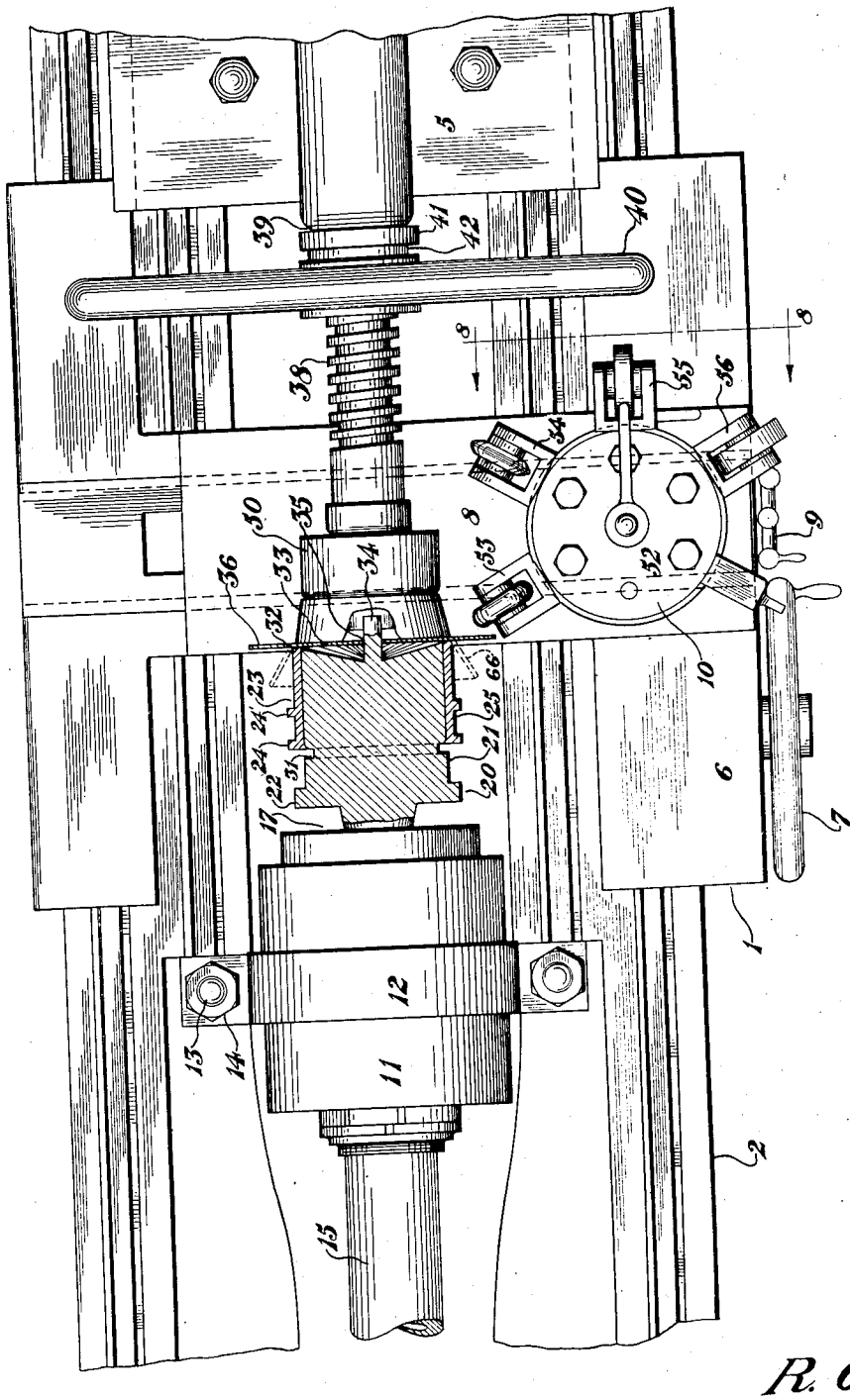


Fig. 2

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3 Sheets-Sheet 3

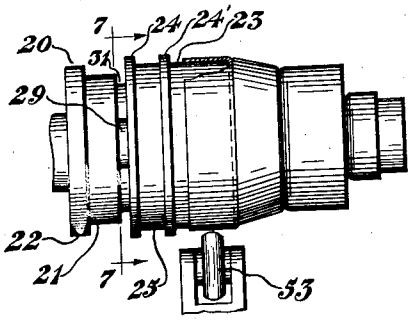


Fig. 3

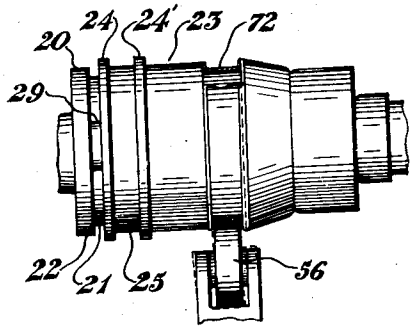


Fig. 6

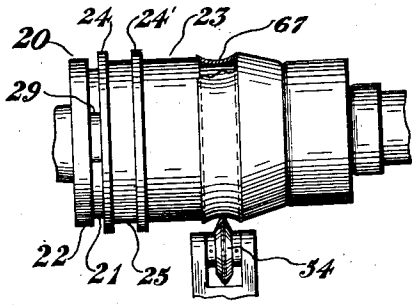


Fig. 4

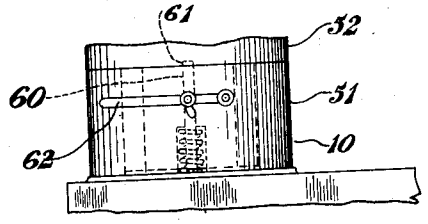


Fig. 8

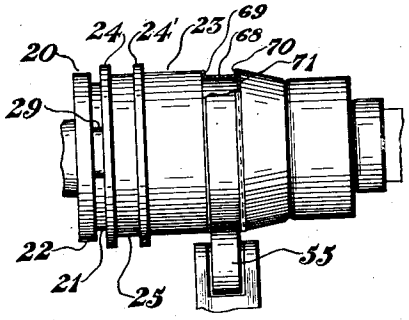


Fig. 5

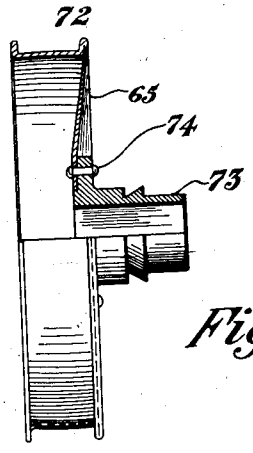


Fig. 9

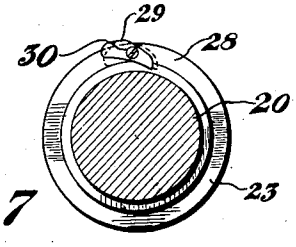


Fig. 7

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Patented June 5, 1928. 1,671,994

UNITED STATES PATENT OFFICE.

REYNOLD G. NELSON, OF CANTON, OHIO, ASSIGNOR TO THE SPUN STEEL CORPORATION, OF CANTON, OHIO, A CORPORATION OF OHIO.

METAL-SPINNING APPARATUS.

Application filed September 9, 1926. Serial No. 134,432.

My invention relates to apparatus for spinning, as from blank disks of sheet or strip metal, articles having tubular portions and one or more flange portions integral therewith, such as crown pulleys.

Metal spinning apparatus heretofore in use has been adapted principally for the spinning of articles of manufacture such as kitchen utensils and the like from the lighter gauges, as 16 gauge and thinner, of sheets or strips of the soft metals such as brass, aluminum, and the like.

The objects of the present improvements are: First, to provide apparatus for spinning from the heavier gauges, as 16 gauge and thicker and including quarter inch thick sheets or strips not only of the soft metals such as brass, aluminum, and the like, but also of steel, articles of manufacture, as aforesaid, such as pulleys;

Second, to provide metal spinning apparatus adapted for completely spinning, finishing, and dynamically balancing a pulley or the like during a continuous rotation of the spinning arbor of the apparatus;

Third, to provide metal spinning apparatus adapted for convenient control and operation; and

Fourth, to provide metal spinning apparatus enabling the production of articles of manufacture as aforesaid in small quantities at a cost less than the cost of making such articles by the use of relatively expensive dies in punch presses, draw presses, and the like.

These and ancillary objects are attained in the present improvements by a construction and arrangement which may be described in general terms as including a bed having operatively mounted thereon an improved spinning headstock provided with a spindle drive shaft journaled in roller bearings for resisting thrust and axial loads, the spindle shaft being adapted to receive an improved spinning arbor having a sliding spinning form sleeve thereon, and the bed also having operatively mounted thereon an improved tailstock including a hand wheel mounted at the side adjacent the spinning headstock for operating an improved ball bearing clamping head for securing the work upon the spinning arbor, and an improved turret tool holder for a plurality of rotary spinning tools all mounted on ball or roller bearings, a trimming tool and the like.

A preferred embodiment of the invention is illustrated in the accompanying drawings forming part hereof in which

Figure 1 is a fragmentary side elevation, with portions in longitudinal vertical cross section, of the improved metal spinning apparatus, the improved turret tool holder being removed;

Fig. 2, an enlarged fragmentary plan view thereof with portions in section, the improved turrent tool holder being in place, and the apparatus being set up as for starting the spinning, finishing, and dynamically balancing of a crown pulley complete from a blank disk during a continuous rotation of the spinning arbor by the use of the various tools in the turret tool holder;

Fig. 3, a detachable fragmentary plan view of the improved arbor and a spinning tool at the completion of the spinning operations of the first tool;

Fig. 4, a similar view at the completion of the spinning operations of the second tool;

Fig. 5, a similar view at the completion of the spinning operations of the third tool;

Fig. 6, a similar view at the completion of the spinning operations of the last tool;

Fig. 7, a sectional view as on line 7—7, Fig. 3 of the improved spinning arbor;

Fig. 8, a detached fragmentary side elevation of the improved turret tool holder viewed as in the direction of the arrows 8—8, in Fig. 2;

Fig. 9, a part side elevation and part transverse vertical cross-section of a complete pulley made by the use of the improved metal spinning apparatus; and

Fig. 10, a detached fragmentary plan view of the improved arbor and the sleeve sliding lever therefor.

Similar numerals refer to similar parts throughout the drawings.

The improved metal spinning apparatus indicated generally at 1 includes a bed 2 supported by suitable legs 3, and the bed 2 may be of any desired length. An improved spinning headstock 4 is adjustably mounted in a well-known manner at a desired longitudinal location upon the bed 2, and an improved tailstock 5 is likewise adjustably mounted upon the bed in a well-

known manner at a desired longitudinal location adjacent the headstock.

Between the headstock and the tailstock a longitudinal feed carriage 6 is mounted in a well-known manner for longitudinal movement between the headstock and the tailstock by rotation of the longitudinal feed carriage control wheel 7. A cross feed carriage 8 is mounted upon the longitudinal feed carriage 6 for cross movement in a well-known manner by operation of the cross-feed carriage crank 9 and the improved turret tool holder 10 is mounted on the cross feed carriage 8.

For resisting both thrust and radial loads, the improved headstock 4 is provided at its ends with roller bearings 11 and 11′ removably secured thereon, as by caps 12 and 12′ and cooperating studs 13 and nuts 14. A spindle drive shaft 15 is journalled in the spaced bearings 11 and 11′ and has keyed thereon between the bearings a drive pulley 16 for operative connection as by a belt, not shown, with a power shaft. At the spinning end 17 of the headstock the spindle shaft 15, which is preferably tubular, is provided with an inner taper 18 for receiving and fitting with the tapered end 19 of the improved spinning arbor 20.

The improved spinning arbor 20 includes, axial with the tapered end 19, a cylindric combined sleeve bearing and spinning form 21 preferably having an outwardly extending sleeve stop flange 22 adjacent the tapered end 19, and a spinning form sleeve 23 is slidably mounted on the sleeve bearing. The spinning form sleeve 23 is provided with a pair of spaced outwardly extending sleeve flanges 24 and 24′ forming an annular groove 25 for receiving a sleeve sliding finger 26 secured in the end of a lever 27 pivotally mounted at the spinning end 17 of the headstock for selective engagement of the finger 26 with the sleeve groove 25 to slide the sleeve upon the bearing 21, as desired, while the arbor is being continuously rotated.

At the end 28 of the sleeve adjacent the sleeve stop flange 22, a centrifugally operated dog 29 is pivotally secured to the sleeve as by a screw 30, the axis of the pivotal mounting being located away from the center of gravity of the dog, so that one end of the dog will fly outward upon rotation of the sleeve, and the other end of the dog will thereby extend inward for entering an annular groove 31 in the sleeve bearing 21 so spaced that when the dog end is in the groove, the outer end 32 of the sleeve will be maintained in a desired relationship with the outer end 33 of the sleeve bearing, which relationship as illustrated is a transverse alignment of the outer ends of the sleeve and the bearing.

The sleeve bearing and spinning form is also preferably provided with a pilot pin 34 axial therewith and extending outwardly from the outer end of the sleeve bearing for insertion in an aperture 35 of a blank pulley disc 36.

For clamping a blank pulley disc against the outer end of the form, the improved tailstock 5 is provided with a longitudinal aperture 37 axial with the arbor and spindle shaft, and in which aperture screw 38 is slidably keyed, the screw extending towards the headstock beyond the end 39 of the tailstock adjacent the headstock, and there being a thread apertured handwheel 40 screwed upon the screw for abutment with the end 39 of the tailstock, the hub 41 of the handwheel being provided with an annular groove 42 in which a tailstock handwheel finger 43 extends, the finger 43 being secured to the tailstock as by bolts 44, whereby the handwheel may be rotated to move the screw longitudinally towards or away from the arbor.

The clamp bearing end 45 of the screw 38 adjacent the headstock, is preferably of smaller diameter than the main body of the screw and is provided with a clamp bearing sleeve 46 suitably flanged as at 47 for abutment with a compressible washer 48, preferably made of rubber, between the flange end of the bearing sleeve and the end of the main screw body. The sleeve 46 has mounted thereon a radial and thrust ball or roller bearing 49 which carries the clamping head 50 for abutment with a blank disk 36 by rotation of the handwheel 40, whereby the blank disk may be securely clamped for rotation upon the outer end of the arbor, as best illustrated in Fig. 2.

The improved turret tool holder 10, mounted upon the cross feed carriage 8, preferably includes a stationary base 51 upon which a turret head 52 is rotatably mounted. In the turret head 52 a plurality of radially extending rotary spinning tools 53, 54, 55 and 56 all mounted on ball or roller bearings, as well as a trimming tool 57, may be secured in suitable sockets therein as by cap screws 58, and a suitable turret handle 59 may be provided for rotating the turret head upon its base.

For selectively setting the several tools in the turret head in operative relationship with the spinning arbor, the turret base may have mounted therein a spring pressed plunger 60 which extends upward into any of the plurality of sockets 61 which may be registered therewith, and the plunger is provided with means for withdrawing it from the socket which may include a hand lever 62 pivoted to the base 51 as at 63 and pivotally connected with the plunger as at 64.

The improved metal spinning apparatus thus described in detail may be used for

spinning as from a blank disk of sheet or strip metal, articles having tubular portions and one or more flange portions integral therewith such as a crown pulley 65 illustrated in Fig. 9.

The blank pulley disk 36 is provided with a central aperture 35 for clamping as aforesaid against the outer end of the spinning arbor 20 by means of the clamping head 50 advanced to abut the blank disk 36 by rotation of the handwheel 40.

The turret head 52, carrying the plurality of rotary ball or roller bearing mounted spinning tools 53, 54, 55 and 56 as aforesaid, is then set up as illustrated in Fig. 2, with the first rotary spinning tool 53 arranged with its axis of rotation angled to the arbor axis.

The first spinning tool 53 has preferably a curved outer periphery as shown. The spindle shaft is then continuously rotated, preferably at a speed of 1500–1800 R. P. M., and the outer surface of the disk is preferably coated with a film of oil having a sufficiently heavy body to remain on the disk during its rotation without being thrown therefrom by centrifugal force.

With the first spinning tool angled as aforesaid, and the arbor rotating continuously, the operator turns the longitudinal feed carriage control wheel 7 and the cross feed carriage crank 9 to longitudinally and transversely bring the rotary spinning wheel into contact with the blank disk and spin the same down as to the form illustrated in dotted lines at 66 in Fig. 2, or to the form illustrated in Fig. 3.

The hand lever 62 on the turret base is then depressed to withdraw the plunger 60 from the socket, setting the turret head in the position illustrated in Fig. 2, whereby the turret head may be turned for setting the axis of rotation of the rotary tool 53 parallel with the arbor axis and hand lever 62 may be released to permit the spring pressed plunger 60 to extend upward into the socket 61 for setting the turret head in the new position.

The longitudinal feed carriage control wheel 7 and the cross feed carriage crank 9 are then turned, with the arbor continuously rotating, to finish spin over the form sleeve 23 the blank disk to the cup shape illustrated in Fig. 3.

The turret head is then set with the second spinning tool 54 arranged with its axis of rotation parallel to the arbor axis. The second spinning tool has preferably an angled outer periphery as shown. With the arbor still continuously rotating the lever 27 is moved so that the finger 26 extends into the groove 25 of the form sleeve 23, and the rotating sleeve causes the heavy end of the dog 29 to strike against the lever 27 elevating the light end of the dog out of the annular groove 31 in the sleeve bearing, and the lever is then operated to slide the sleeve 23 from beneath the cup, to a position against the sleeve stop 22.

By operation of the longitudinal feed carriage control wheel and the cross feed carriage crank, and with the arbor still continuously rotating, the tubular portion 66 of the cup shape illustrated in Fig. 3 is provided with the internally curved groove 67 as best illustrated in Fig. 4, the sliding of the sleeve 23 from beneath the tubular portion of the cup as aforesaid permitting the formation of the groove.

The turret head is then rotated to bring the axis of the third rotary spinning tool 55 parallel with the arbor axis, and the third spinning tool being cylindric in shape, by operation of the longitudinal feed carriage control wheel and the cross feed carriage crank as aforesaid the groove tubular portion of the cup is spun down to the shape illustrated in Fig. 5, including a cylindric tubular portion 68 provided with an outer peripheral flange 69 and an inner peripheral flange 70 integral with a disk web 71.

The turret head is then set to bring the laterally oscillatable rotary spinning tool 55 in position for the final spinning operation. The spinning tool 56 is cylindric in shape but the cylindric depth is less than the cylindric depth of the tool 55.

With the arbor still continuously rotating, the cylindric tubular portion 68 is spun as shown in Fig. 6 to form the crown portion 72 of the finished crowned and flanged integral sheet or strip metal pulley 65 which may be provided with a cast hub 73 connected with the sheet or strip crowned and flanged pulley 65 as by rivets 74, as best illustrated in Fig. 9.

By the use of the improved sheet metal spinning apparatus as aforesaid a crowned and flanged sheet or strip metal pulley may thus be spun from a blank metal disk during a continuous rotation of the spinning arbor.

For large orders, it may be economical to form in a punch press the combination blank and cup illustrated in Fig. 3 as having been formed by spinning operations; and if the combination blank and cups are formed in punch presses, the spinning operations are carried on thereafter as aforesaid and as illustrated in Figs. 4 to 6 inclusive.

I claim:

1. A spinning apparatus including a spinning arbor and means for rotating the arbor, the spinning arbor including a combined sleeve hearing and spinning form, and a spinning form sleeve slidably mounted on the bearing, there being an annular groove in one of the arbor members, and a dog mounted on the other arbor member for extending into the groove.

2. A spinning apparatus including a spin-

ning arbor and means for rotating the arbor, the spinning arbor including a combined sleeve bearing and spinning form, and a spinning form sleeve slidably mounted on the bearing, there being an annular groove in one of the arbor members, and a centrifugally operated dog mounted on the other arbor member for extending into the groove.

3. In a spinning apparatus and the like, a spinning arbor including a combined sleeve bearing and spinning form and a spinning form sleeve slidably mounted on the bearing, there being an annular groove in one of the arbor members, and a dog mounted on the other arbor member for extending into the groove.

4. In a spinning apparatus and the like, a spinning arbor including a combined sleeve bearing and spinning form and a spinning form sleeve slidably mounted on the bearing, there being an annular groove in one of the arbor members, and a centrifugally operated dog mounted on the other arbor member for extending into the groove.

5. A spinning apparatus including a spinning arbor and means for rotating the arbor, the spinning arbor including a combined sleeve bearing and spinning form, and a spinning form sleeve slidably mounted on the bearing, there being an annular groove in one of the arbor members, and a dog pivotally mounted on the other arbor member for extending into the groove.

6. A spinning apparatus including a spinning arbor and means for rotating the arbor, the spinning arbor including a combined sleeve bearing and spinning form, and a spinning form sleeve slidably mounted on the bearing, there being an annular groove in one of the arbor members, and a centrifugally operated dog pivotally mounted on the other arbor member for extending into the groove.

7. In a spinning apparatus and the like, a spinning arbor including a combined sleeve bearing and spinning form and a spinning form sleeve slidably mounted on the bearing, there being an annular groove in one of the arbor members, and a dog pivotally mounted on the other arbor member for extending into the groove.

8. In a spinning apparatus and the like, a spinning arbor including a combined sleeve bearing and spinning form and a spinning form sleeve slidably mounted on the bearing, there being an annular groove in one of the arbor members, and a centrifugally operated dog pivotally mounted on the other arbor member for extending into the groove.

In testimony that I claim the above, I have hereunto subscribed my name.

REYNOLD G. NELSON.