

Sept. 13, 1927.

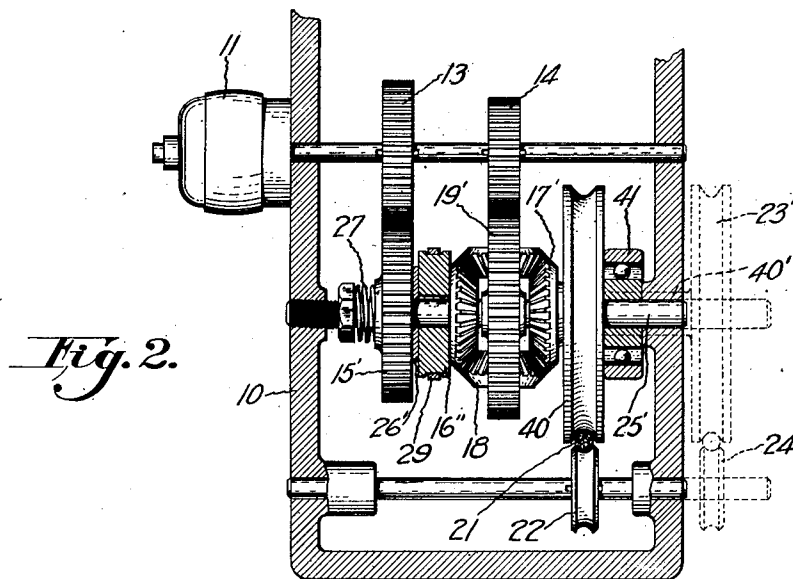
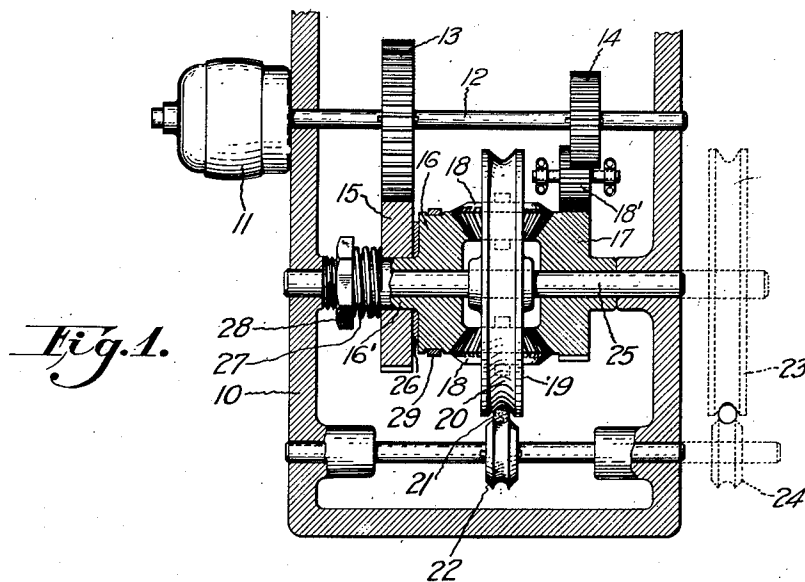
1,642,452

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ELECTRODE FEEDING MEANS

Filed Jan. 27, 1921

2 Sheets-Sheet 1



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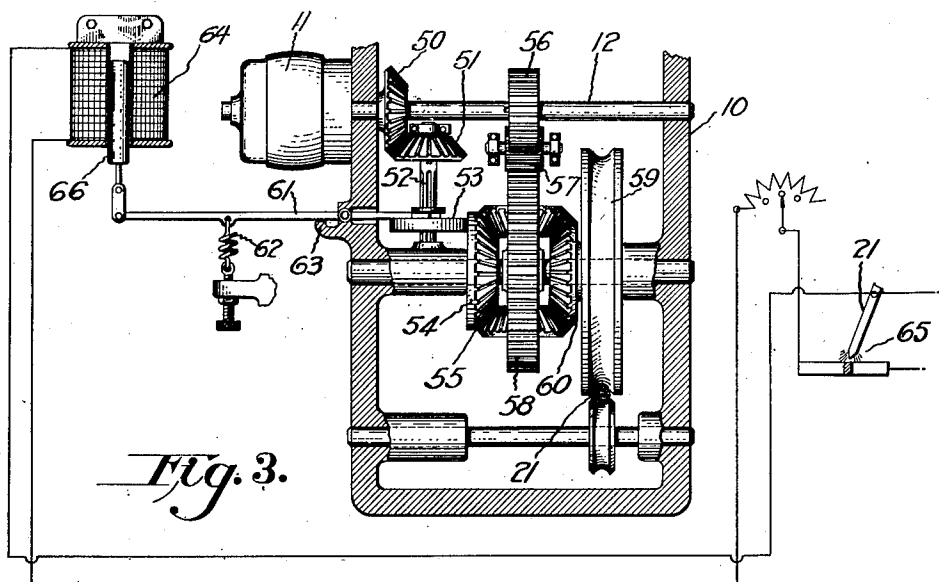


Fig. 3.

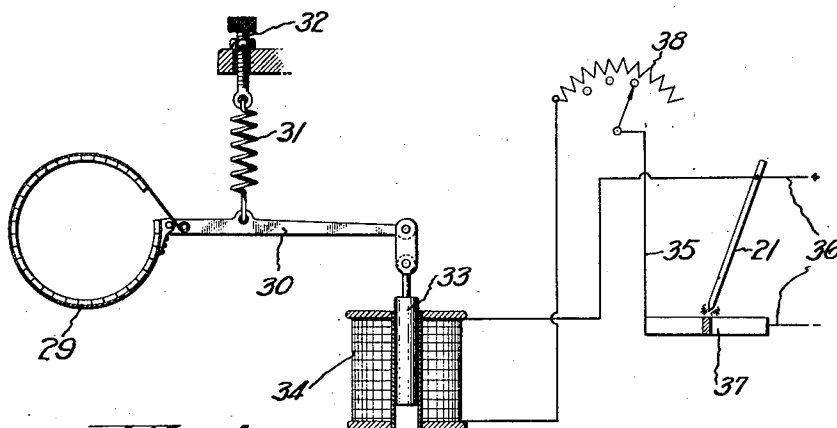


Fig. 4.

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UNITED STATES PATENT OFFICE.

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ELECTRODE-FEEDING MEANS.

Application filed January 27, 1921. Serial No. 440,371.

The invention relates to controlling devices which are responsive to varying electric conditions, and while not limited thereto it is more particularly designed for use in maintaining a supply of metallic electrode material to an electric arc.

In apparatus in which the electric arc is utilized for heating, welding and like operations and more especially where metallic electrode material is employed, the electrode is fused or dissipated under the influence of the heat of the arc. Efficiency of operation, however, demands that the distance separating the conducting materials between which the arc is formed shall vary only between relatively narrow limits and it is therefore necessary to provide for the movement of an electrode at a rate corresponding to the rate at which the said distance tends to change. It is also necessary, upon beginning the operation, to bring the two parts into conducting relation and then produce a gap between them in order to draw the arc. At present it is customary to mount the movable electrode in a clamping device designed to be held in the hand so that the arc may be drawn and the proper length of arc maintained as dictated by the judgment of the operator. It is obvious however that an automatic device whereby these operations could be performed without the constant attention of a skilled workman would be highly desirable.

My invention has for one of its objects therefore the provision of means whereby a body of electrode material may be caused to approach a conducting body connected in circuit with the said electrode, may be retracted when the current begins to flow, thereby drawing an arc, and may thereafter be supplied at such rate as is necessary to maintain an arc of substantially constant length.

A further object is to provide means whereby a constant feeding movement of an object such as a wire or strip may be maintained in response to varying electric conditions such as those occurring in an electric arc.

A further object is to provide means whereby a control element such as a feeding wheel or other control device may be given a movement in either direction at varying

rates, or in opposite directions in rapid alternation, or may be caused to remain stationary at intervals without interrupting the operation of the source of motive power, all in response to varying electric conditions.

A further object is to utilize for the actuation of an electrically controlled or electro-responsive feeding or control device the compounding of motions of differing rates such as is realized in certain gearing constructions of the planetary or epicyclic type.

With these and other objects in view as will appear more fully from the following description the invention consists of the features of novelty hereinafter described and set forth in the claims, together with such modifications thereof as would readily occur to one skilled in the art to which the invention pertains.

In the accompanying drawings, Figure 1 is a horizontal sectional plan view of one form of apparatus embodying the invention.

Figure 2 is a similar view of a modified form.

Figure 3 is a similar view of another modified form including also a diagrammatic showing of the wiring which may be employed, and

Figure 4 is a diagrammatic view of the brake-operating means employed in connection with the forms shown in Figures 1 and 2.

In the form illustrated in Figure 1, 10 indicates a frame or casing which may be of any character suitable to support and house the operating mechanism of the device. A motor 11, which may be an electric motor adapted to rotate at constant speed, is mounted upon or adjacent to the frame and is arranged to drive a shaft 12 carrying two gears 13, 14. The gear 13 is arranged in driving engagement with a gear 15 loosely mounted upon the hub 16' of the bevel gear 16 forming one element of a form of planetary or epicyclic gearing commonly employed in differentials and like relations. The other bevel gear 17 of the epicyclic gear set is driven in a direction opposite to that of gear 16 by engagement of its periphery with the reverse pinion 18' arranged to be

driven by gear 14. The epicyclic or planetary pinions 18, 18, of which two or more are generally employed, are mounted in the rotating frame or carrier 19, which in this form may be provided with a peripheral groove 20 or otherwise suitably shaped to engage and feed a wire, rod or strip of electrode material 21, or such other element as it may be desired to feed by the mechanism described.

A feed wheel 22 may be suitably arranged to co-operate with the periphery of the feed element 19 as is common in this art. Feed devices 23, 24, shown in dotted lines, may be arranged outside the casing 10 or elsewhere if desired, the feed device 23 being attached to the shaft 25 to which the planetary frame or carrier 19 will also be attached if it be desired to drive a feed device at a distance from the said carrier. If the carrier 19 be utilized alone as the driving device it may be mounted loosely upon the shaft 25 thereby reducing to some extent the weight of the rotating parts. In any case the gears 16, 17, will preferably be loosely mounted upon the shaft or spindle 25.

Driving engagement of the gear 15 with the bevel gear 16 is made through a friction clutch 26 which is under the influence of the spring 27. An adjusting nut 28 engaging with threads upon the end of hub 16' is provided to vary as may be desired the pressure of the spring. A brake 29 is arranged to engage with the body of bevel gear 16 whereby the gear may be prevented from rotating at the same speed as gear 15, the clutch 26 being caused to slip more or less as the brake is applied.

As shown in Figure 4 the brake 29 is a common form of strap brake actuated in a direction to apply the brake by downward movement of the brake lever 30. A spring 31, adjustable as by screw 32, is adapted to release the brake. Connected to the end of the brake lever is a solenoid core 33, under the influence of solenoid 34. The winding of the solenoid forms part of a circuit 35 arranged in shunt with the main work circuit 36 shown in this case as connected to electrode 21 and a work piece 37. Any suitable means for varying the resistance of the shunt circuit may be employed for adjustment of the relative current flow through that circuit, for example the rheostat 38.

The gear ratios will be preferably so selected and the parts so arranged that gear 17 will rotate normally at a rate slightly different from that of gears 15 and 16 when these latter rotate together, the brake 29 being released. If element 21 be assumed to be metallic electrode material to be supplied to an electric welding arc then gear 16 may rotate faster than gear 17 and in a direction to move the electrode away from the arc. As the resistance in the arc increases,

however, due to its increasing length, the current in the shunt circuit including solenoid 34 increases, thereby applying the brake 29 and reducing the speed of gear 16 below that of gear 17 whereupon the direction of rotation of carrier 19 will be reversed, as is obvious, and the electrode material 21 will be caused to travel toward the work. By suitable adjustment of the clutch and brake and of the resistance of the shunt circuit relative to that of the main circuit the speed ratios may be so regulated as to maintain an arc of uniform length.

Upon beginning operations, the electrode material being presumably not in contact with the work, the motor 11 will be started by any suitable arrangement of control devices when the welding current is turned on. The heavy flow of current through the shunt circuit will first cause the electrode to approach the work until conducting relation is established therewith. The immediate reduction of flow through the shunt circuit will permit the withdrawal of the electrode, thus drawing the arc, after which the operation will proceed as above described.

It will be understood that if the rate of rotation of gear 16 is exactly the same as that of gear 17 the planetary carrier 19 will remain stationary and in practice, when employed for feeding metallic electrode material, it will intermittently pass through a state of rest and of motion backwardly and forwardly with considerable rapidity, the electrode being slowly lifted as a globule of molten material collects at its extremity and quickly lowered when the globule is deposited.

In the form shown in Figure 2 the gear 14 is arranged to drive directly the gear carrier 19', the latter being loose on spindle 25'. Gear 13 is arranged to drive the gear 15' and through clutch 26' the bevel gear 16'' as in the form first described. In this case the bevel gear 17' supports the feed wheel 40, and, if desired, the feed wheel 23' shown in dotted lines, the feed wheels being connected by a sleeve 40'. Suitable antifriction bearings, as indicated at 41, may be employed where desirable. In this form it will be seen that the reverse gear 18' is eliminated, thus simplifying the driving mechanism, and that the mounting of the feed device upon one of the bevel gears reduces materially the weight and inertia of the parts whose rotation must be intermittently and suddenly reversed. In this case it will be obvious that the gear carrier 19' should be arranged to travel at a rate slightly less than one-half that of gear 16'' when the brake 29 is not applied in order to cause the element 21 to move upwardly as in the form first described.

The form shown in Figure 3 is designed to eliminate the use of a brake and substi-

tute a speed-changing gear mechanism to vary the rate of rotation of one element of the epicyclic gear set. In this case the motor shaft 12 carries the bevel gear 50 in driving engagement with bevel gear 51 on shaft 52. Splined upon the shaft 52 and slidable thereon is friction pinion 53 arranged to contact with a friction surface 54 on one of the bevel gears of the planetary set, as 55. A gear 56 on shaft 12 engages reversing pinion 57 which latter drives the gear carrier 58, the object being to drive the carrier normally at slightly less than one half the rate of gear 54 and in the same direction, the operation being the same in this respect as in the form shown in Figure 2, the feed wheel 59 being carried by the other bevel gear 60 similarly to the parts 40 and 17' of Figure 2.

The friction pinion 53 is arranged to be shifted radially of the friction surface 54 as by lever 61. A spring 62 operates to retract the lever against a stop 63 to thereby permit the gear 55 to be driven at the desired rate sufficient to cause element 21 to be fed upwardly or away from a work piece. Solenoid 64 is arranged in shunt with the arc at 65 as in the forms already described, and the solenoid core 66 is connected to the lever 61 and operates to shift the pinion 53 toward the center of the friction gear and thereby reduces the speed of the latter sufficiently to render stationary or reverse the feed of the element 21.

It will be understood that various other forms of gearing may be employed to vary progressively the speed of one member of the epicyclic gearing, also other forms of epicyclic gearing may be employed, the gearing shown being merely illustrative of operative forms of such mechanism.

Many other changes may be made in ratios and arrangements of gears and in other details of construction without departing from the principle of the invention and I therefore do not desire to be limited to the specific structure shown.

I claim:

1. In mechanism of the class described, a rotatable control device, two gears in driving engagement with said control device, said device and gears so arranged that the direction and rate of rotation of said device is dependent upon the relative rates of rotation of said gears, a friction member interposed between one of said gears and the control device and means responsive to electric conditions adapted to vary the relative rates of rotation of said gears.

2. In electro-responsive feeding or controlling mechanism the combination of a rotatable actuating device, epicyclic gearing for causing the rotation of said device, a friction member adapted to drive a part of said gearing and means responsive to elec-

tric conditions for varying the rate of rotation of a part of said gearing.

3. In combination a movable actuating device, epicyclic gearing for communicating motion to said device comprising two independently driven parts, a friction clutch adapted to drive one of said parts and means responsive to electric conditions for varying the relative rates of rotation of said parts.

4. In combination a rotatable actuating device, epicyclic gearing for causing rotation of said device comprising two independently driven parts, means for actuating one of said parts at a constant speed, means for actuating the other of said parts at variable speed, and means responsive to electric conditions for controlling said variable speed.

5. In electric arc apparatus the combination of a device for feeding an electrode to an arc, means for actuating said device comprising trains of gearing constructed and arranged to vary the direction of movement of said device by varying the relative rate of movement in said trains, and means responsive to conditions in said arc for varying said relative rate of movement.

6. In electrode feeding mechanism a rotary electrode feeding device, epicyclic gearing for actuating said device, means for driving parts of said gearing at varying rates to thereby vary the rate and direction of movement of said device, and electric means for controlling said driving means.

7. Electrode feeding mechanism comprising a device adapted to feed metallic electrode material, epicyclic gearing adapted to actuate said device to feed the material in either direction and at varying rates, and control means for said gearing comprising a device arranged in shunt with the arc.

8. In combination a driven element and means for rotating said element in either direction at variable speed comprising epicyclic gearing one of the parts of which is in driving relation to said element, two trains of gears arranged to actuate said gearing, one train tending to drive said element in one direction and the other in the opposite direction, one of said trains including a frictional clutch connection, and means for varying the slippage in said clutch connection to vary thereby the rate of movement transmitted by said connection.

9. Epicyclic gearing comprising a gear carrier and two gears, a driven element arranged to rotate with one of said parts, and means for rotating each of the other parts, one of said rotating means including a frictional clutch connection, and means for varying the slippage in said clutch connection to vary thereby the rate of movement transmitted by said connection.

10. Electrode feeding mechanism compris-

ing a rotary electrode-feeding device, epicyclic gearing having a gear carrier and two gears, said device being arranged to rotate with one of the parts of said gearing, means
5 for driving another of said parts tending to rotate said device in one direction, means for driving the third part tending to rotate
said device in the other direction and means responsive to conditions in the arc adapted to vary the rate of movement transmitted 10 by one of said driving means.

In testimony whereof I affix my signature.

GEORGE A. LOVETT.