Feb. 28, 1933. R. SARAZIN 1,899,829

AUTOMATIC MACHINE WITH MAGNETIC PLATES FOR REGULATING ARCS

Filed March 19, 1931

Fig. 1.

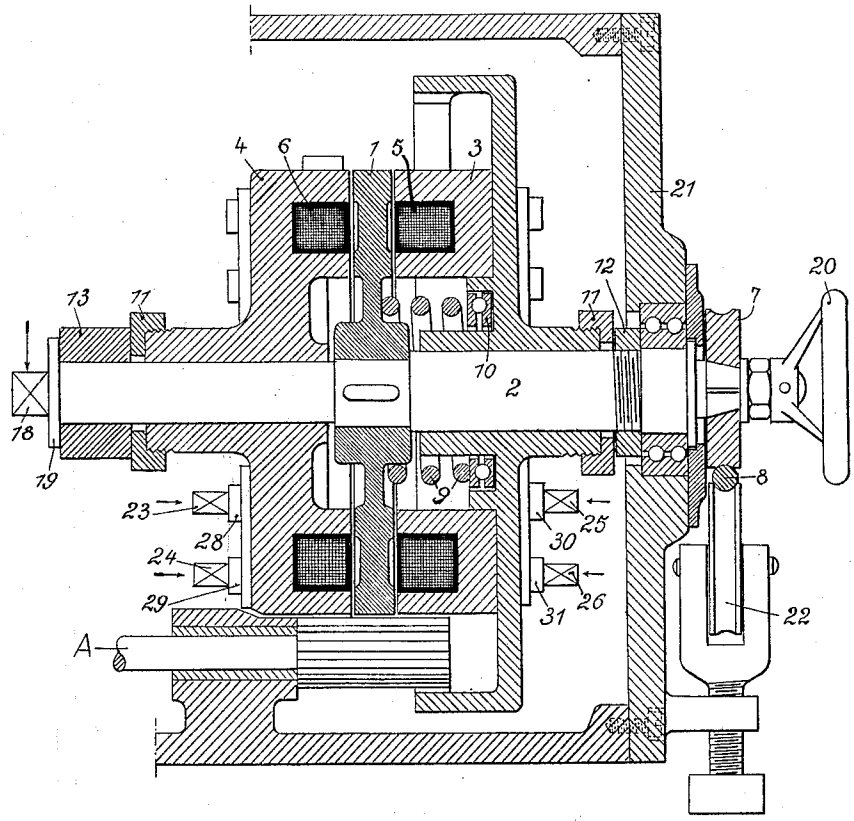
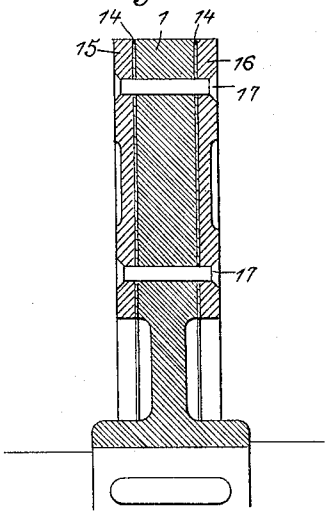


Fig. 2.



R. Sarazin
INVENTOR

By: Marks & Clerk
Attys.

Patented Feb. 28, 1933 1,899,829

UNITED STATES PATENT OFFICE

ROBERT SARAZIN, OF NEUILLY-SUR-SEINE, FRANCE

AUTOMATIC MACHINE WITH MAGNETIC PLATES FOR REGULATING ARCS

Application filed March 19, 1931, Serial No. 523,889, and in France March 24, 1930.

In the U. S. Patent application Serial No. 196,880, since matured into Patent No. 1,866,675, dated July 12, 1932, I have described a simple, quick and reliable device for automatically regulating electric arcs, and in particular those used for electric welding.

The automatic machine described in said application gives very good results which are rendered still more remarkable by the improvements according to my present invention.

In the above mentioned patent application, the central disk is attracted by either of the two magnetic plates; this arrangement makes it necessary for the disk to slide along the shaft and the feather keys through which it is driven so that wedging may occur and cause a bad operation of the apparatus, or even a jamming of the disk on the shaft in the case of an excessive play in the grooves, which results in a delay which is detrimental to the good working of the device.

According to my present invention, disk 1 is keyed in a fixed position on shaft 2, while, on the contrary, plates 3 and 4, which are given inverse rotary motions, slide in a lateral direction and come into contact with either of the faces of the disk.

Plates 3 and 4 carry coils 5 and 6 either of which is fed through a relay placed directly or indirectly under the control of the arc.

Disk 1 may therefore be rotated in either direction, either forward or backward, and thus determine all the necessary corresponding adjustments. According to the present invention, the feeding roller 7 for driving the electrode wire 8 will be keyed on the same shaft, so that a positive and instantaneous action will be produced which could not be obtained if a system of speed reducing gears was interposed as disclosed in the above mentioned patent application which provided for instance the use of an endless screw.

The direct mounting of feeding roller 7, adapted to drive wire 8, on the shaft 2 that carries disk 1 necessitates a very powerful regulating system and it is natural that one should think of diminishing the air-gap for, as it is known, the attractive force of the disk with respect to the plates varies in direct ratio to the square of the induction. Plates 3 and 4 are therefore machined and ground in such manner as to allow contact of the disk with the adjoining faces, or otherwise if a slight interval is provided, small elements made of a nonmagnetic material will be used to avoid adherence of the disk to the plate due to residual magnetism; for said adherence must be avoided because it slackens the action of the regulator.

The action of atmospheric pressure is also important for it tends to add itself to the adherence due to residual magnetism and to maintain the disk strongly applied against the plate that has attracted it. A counteracting spring 9 will be provided whose strength will be at least equal to the value of the atmospheric pressure applied to the surfaces in contact. The ends of said spring will conveniently bear on thrust ball bearing 10.

Adverting to Fig. 1, it will be seen that a spring 9 has been mounted only on plate 3. The latter is intended to convey the electrode toward the piece, and must act quite instantaneously. That condition is less important for plate 4 which is intended for backward motion, but said plate could also be provided with a spring and a thrust bearing. That detail of construction is chiefly interesting for automatic welding by means of a pencil of graphite.

It is important that the interval between the plates and the disk at rest should be kept constant and adjustable; for this purpose the ends of the plate hubs are provided with a system for adjusting the lateral play.

The outer ends of the hubs of plates 3 and 4 are screw threaded and rings 11 are adapted to be adjustably screwed thereupon so as to allow an adjustment of the position of said plates with respect to fixed parts such as, on the one hand, nut 12 on shaft 2, and, on the other hand, the side of bearing 13.

In order to assure that the faces of the disk may be better applied against the magnetic plates, according to the present invention, the disk may be provided with a hub keyed on shaft 2. Said hub carries, integral with it,

a thin web which is adapted to be elastically deformed so as to allow the rim of the disk to be applied exactly flatwise on the magnetic plate that attracts it.

Finally the disk may be slit along several radii in such manner that each of the sectors thus cut may be separately attracted and the contact of the disk on the plate still improved.

These details are very important, because the least air-gap will considerably reduce the power and the machine must be so constructed as to have the minimum weight and to occupy as little space as possible. It will readily be understood that the application of the above described improvements will very much increase the value of the force exerted by the feeding roller for driving the wire while avoiding any slip, during the rotation, of disk 1 against plate 3 or 4 by which it is attracted.

It has already been stated that the action of the residual magnetism is to be avoided as much as possible. Therefore, according to the present invention, plates 3 and 4 and disk 1 will be made of steel as mild as possible, presenting but a small residual magnetism.

Experiments have shown that a supplementary interferric gap consisting for example of a nonmagnetic sheet interposed between the faces of disk 1 and the faces of plates 3 and 4 did not give advantageous results, for that sheet had to be made relatively thick in order to have a sufficient mechanical strength, and accordingly the attractive force was too much reduced.

The present invention therefore comprises a very important improvement which is as follows: Both faces of the organ keyed on the shaft, which will be called "disk" for the sake of clearness, are rectified, and a nonmagnetic sheet 14 is applied on each of these faces, said sheet consisting for example of thin paper. One or two rims made of soft steel 15 and 16 are then disposed on either side of the disk so as to form a composite rim whose parts are held together by means of rivets for example.

The value of the residual magnetism is thus reduced to what it would be if the rim consisted only of the two outer small elements of soft steel, that is to say to a value that may be considered as negligible for practical purposes.

The mode of constructing the magnetic plates is not immaterial for they greatly cooperate toward the good working of the regulator. According to the present invention, electric coils 5 and 6 are inserted in deep grooves provided in the plates and are kept in position by suitably screwed fixation plates.

In a magnetic circuit of that kind it will be noticed that when the current of the electric coil is cut off, there takes place, due to the sudden variation of the magnetic field, a phenomenon of mutual induction which sets up a current in the core formed by the iron magnetic circuit. Said current produces a new local magnetic field the effect of which is to keep the disk against the plate for a slightly longer time.

The present invention makes it possible to obviate this drawback by slitting along a radius the magnetic circuits located on either side of the disk, so as to prevent the flow of a secondary current which might be set up when the current flowing in the coil of the magnetic plate is suddenly cut off.

The gap resulting from that slit will preferably be filled with an insulating substance so as to prevent metallic particles from subsequently closing the circuit.

According to the present invention, which provides a driving feeding roller 7 directly mounted on the shaft that carries disk 1, the wire is forced between said roller 7 and a counter-wheel 22 and the pressure may be considerable and even cause seizing of the shaft, but any such possibility is avoided owing to the fact that according to my invention the shaft that carries the disk and the feeding roller is fitted with roller or ball bearings.

My invention also provides that for, very high intensities in the arc, the electric current may be fed to the electrode through said driving milled wheel, independently of the organ generally used for this purpose.

In that case, according to my invention, a sliding contact is provided for feeding current to shaft 2, said contact consisting for instance of a brush 18 bearing against a copper piece 19 secured at the end of shaft 2, the electric current being supplied to that brush through a suitable connection and passing through the shaft to roller 7 from which it passes into the electrode wire.

Before starting the machine and after stopping it, it is advantageous to be able to move by hand the electrode wire with respect to the piece, either forward or backward according to the needs. My invention makes it possible, through the direct keying of the disk on the shaft that carries the milled wheel, to easily provide that improvement. For this purpose a small hand-wheel 20 makes it possible to rotate said feeding roller 7 at will so as to move the wire upwards or downwards.

The various improvements that have been above described are parts of a whole such as described in the machine shown in Fig. 1. These details can be taken either separately or in combination and be applied to the whole of the regulating system or merely to a part thereof. Likewise, the magnetic plates might be separate and each comprise its disk without departing from the spirit of my invention.

In the specific example shown, in order to facilitate the construction, it has been en-

deavored to assemble the organs in such manner as to form a compact and homogeneous machine. To this effect, in order to facilitate the taking to pieces, the regulator is enclosed in a casing which encloses the bearings. By unscrewing the nuts that serve to secure the front plate 21, it is possible to remove said plate, and, together with it, the whole inner mechanism. It will be noticed that said plate 21 also carries the counter-wheel 22, which serves to forcibly apply electrode wire 8 against feeding roller 7. That mode of construction is part of the present invention.

It has been stated that plates 3 and 4, and also disk 1, were made of extremely mild steel, in order to avoid as far as possible residual magnetism. According to the present invention, the faces of said pieces adapted to come into contact with each other may be submitted to a hardening treatment, so as to do away with wear and tear. Such a treatment may consist for instance in cementing the surface of the pieces, the other parts of said pieces being preferably protected before that operation so as to avoid the formation of a carburized zone.

In Fig. 1 it will be seen that the system is mechanically driven through a driving shaft A provided with a pinion adapted to mesh with teeth provided on the one hand on the outer periphery of plate 4, and, on the other hand, on the inner periphery of an annular gear surrounding plate 3 and integral therewith, so that plates 3 and 4 may be driven in opposite directions. Said shaft A rotates at a suitable speed for driving the regulating system. It may have a variable speed or be connected with a change-speed box.

Lastly, an auxiliary source of current is connected to coils 5 and 6 of the magnetic plates through brushes 23 and 24, and 25 and 26, which are provided with insulated rings 28, 29 and 30, 31, respectively connected to said coils. It has already been stated that the flow of current to one or the other of these coils was controlled through a relay depending either directly or indirectly on the phenomenon or the system which is to be regulated by the apparatus.

It should be well understood that the above described improvements are particularly adapted to be used in connection with machines for regulating electric arcs, but obviously they could also be used in connection with any mechanical device comprising a magnetic plate adapted to transmit a discontinuous movement, whatever be the particular embodiment of the apparatus.

What I claim is:

1. In a regulating device of the type described, a shaft, a disk made of a magnetizable metal rigidly keyed on said shaft, two magnetizable plates mounted loose on said shaft on either side of said disk respectively, means for oppositely driving said plates, and electric means for magnetically energizing one of said plates, whereby it is brought into contact with the intermediate disk.

2. In a regulating machine of the type described for arc welding machines, a shaft, a disk made of a magnetizable metal rigidly keyed on said shaft, two magnetizable plates mounted loose on said shaft on either side of said disk, means for oppositely driving said plates, electric means for magnetically energizing one of said plates whereby it is brought into contact with the disk, an electrode wire, and a feeding roller keyed to said shaft for driving said wire.

3. In a regulating machine of the type described, a shaft, a disk made of a magnetizable metal rigidly keyed on said shaft, two magnetizable plates mounted loose on said shaft on either side of said disk, means for oppositely rotating said plates, a spring interposed between one of said plates and the disk, and electric means for magnetically energizing one of said plates whereby it is brought into contact with the disk.

4. In a regulating device of the type described for arc welding machines, a shaft made of a magnetizable metal rigidly keyed on said shaft, two magnetizable plates mounted loose on said shaft on either side of said disk, means for oppositely rotating said plates, a spring interposed between one of said plates and the disk, means for magnetically energizing either of said plates, whereby it is brought into contact with the disk, an electrode wire, and a feeding roller keyed to said shaft for driving said wire.

5. A regulating device according to claim 1 further comprising means for adjusting the air-gap between the disk and the plates.

6. In a regulating device of the type described for arc welding machines, a shaft made of a magnetizable metal rigidly keyed on said shaft, two plates made of a magnetizable metal mounted loose on said shaft on either side of said disk, means for oppositely rotating said plates, a spring interposed between one of said plates and said disk, outwardly extending hubs on said plates, two rings adjustably screwed on the outer ends of said hubs respectively for adjusting the air gaps between the disk and the plates respectively, electric means for magnetically energizing either of said plates, whereby it is brought into contact with the disk, an electrode wire, and a feeding roller keyed to said shaft for driving said wire.

7. In a regulating device of the type described for arc welding machines, a shaft, a disk made of a magnetizable metal rigidly mounted on said shaft, two plates made of a magnetizable metal mounted loose on said shaft on either side of said disk, means for oppositely rotating said plates, electric means for magnetically energizing either of said plates whereby it is brought into contact

with the disk, an electrode wire, a feeding roller keyed to said shaft for driving said wire, a casing surrounding the whole mechanism, and a plate for closing said casing adapted to support said shaft and all the pieces mounted thereon.

8. A regulating device according to claim 1 in which the disk and the plates are made of very mild steel.

9. A regulating device according to claim 2 in which the disk and the plates are made of very mild steel.

10. In a regulating device of the type described for arc welding machines, a shaft made of a magnetizable metal rigidly keyed on said shaft comprising a relatively thin flexible web, two plates made of a magnetizable metal mounted loose on said shaft on either side of said disk, means for oppositely rotating said plates, electric means for magnetically energizing either of said plates whereby it is brought into contact with the disk, an electrode wire, and a feeding roller keyed to said shaft for driving said wire.

11. In a regulating device of the type described for arc welding machines, a shaft made of a magnetizable metal rigidly keyed on said shaft comprising a relatively thin flexible web and provided with radial slits, two magnetizable plates mounted loose on said shaft on either side of said disk, means for oppositely rotating said plates, electric means for magnetically energizing either of said plates whereby it is brought into contact with the disk, an electrode wire, and a feeding roller keyed to said shaft for driving said wire.

12. In a regulating device of the type described for arc welding machines, a shaft, a disk made of a magnetizable metal rigidly mounted on said shaft, two metallic plates made of a magnetizable metal mounted loose on said shaft on either side of said disk and provided each with a circular groove, a coil in each groove, means for feeding electric current to either of said coils whereby the corresponding plate is brought into contact with the disk, means for oppositely rotating said plates, an electrode wire, and a feeding roller keyed to said shaft for driving said wire.

13. A regulating device according to claim 12 in which each of the metallic plates is provided with radial slits filled with an insulating material, so as to avoid the formation of currents in said plates when the electric current is cut off in the corresponding coil.

14. A regulating device according to claim 1 in which the disk comprises a rim, an annular sheet of a nonmagnetic material applied on the side of said rim, and a thin annular plate of very mild steel applied over said sheet.

15. A regulating device according to claim 2 in which the disk comprises a rim, an annular sheet of a nonmagnetic material applied on the side of said rim, and a thin annular plate of very mild steel applied over said sheet.

16. A regulating device according to claim 2 further comprising means for feeding current to the feeding roller for driving the electrode wire.

The foregoing specification of my "automatic machine with magnetic plates for regulating arcs" signed by me this 6th day of March, 1931.

ROBERT SARAZIN.