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METHOD OF AND DEVICE FOR ELECTRIC RESISTANCE WELDING

Filed Feb. 11, 1941

Serial No.
378,465

2 Sheets-Sheet 1

Fig. 1.

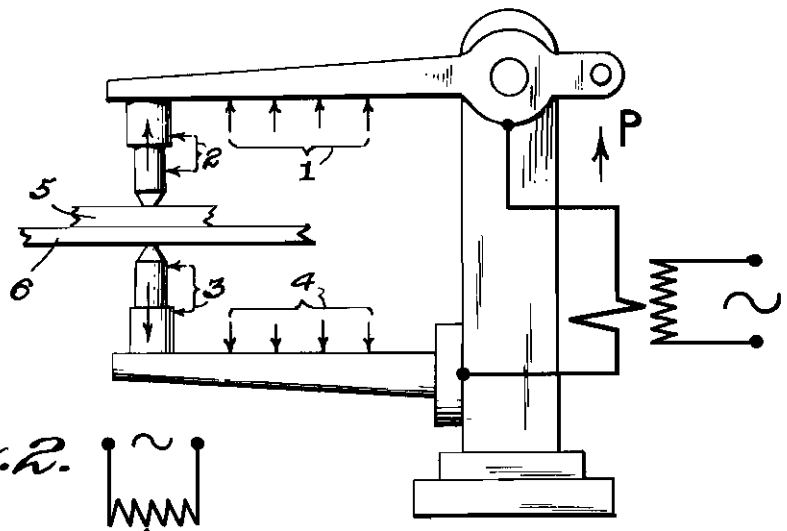


Fig. 2.

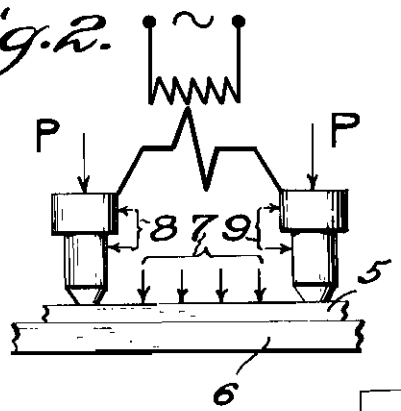
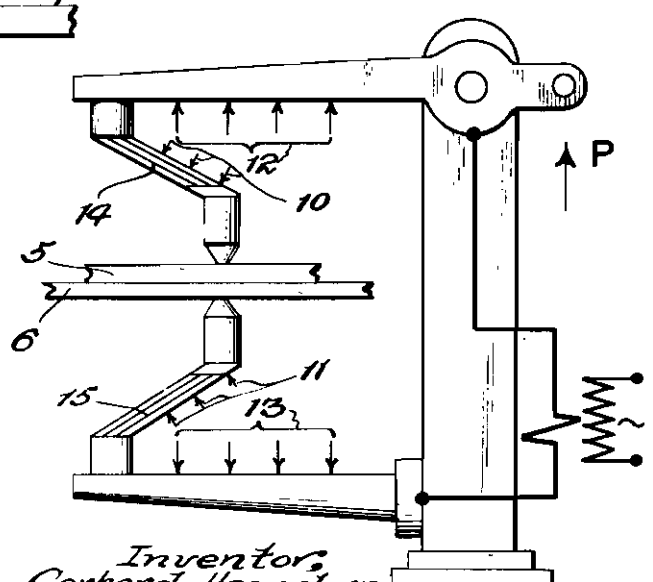


Fig. 3.



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By: Glascock Downing & Sebold Attorneys.

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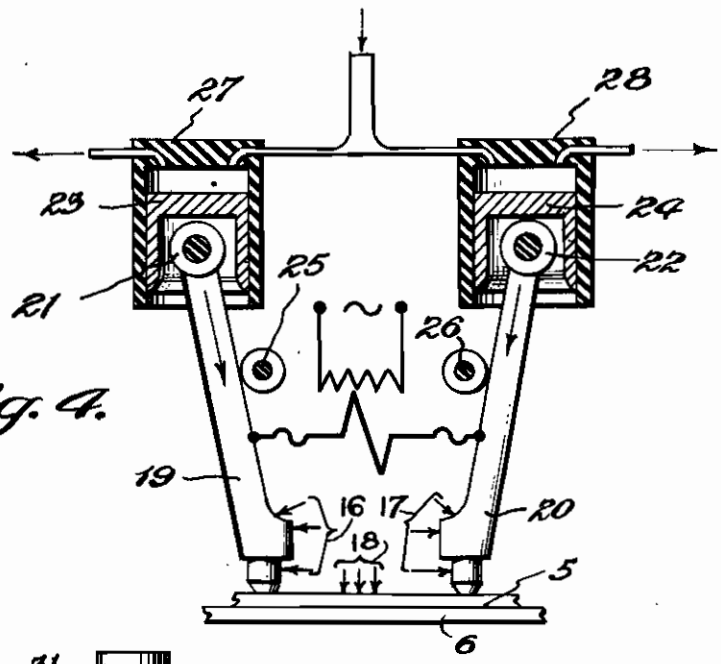

Fig. 4.

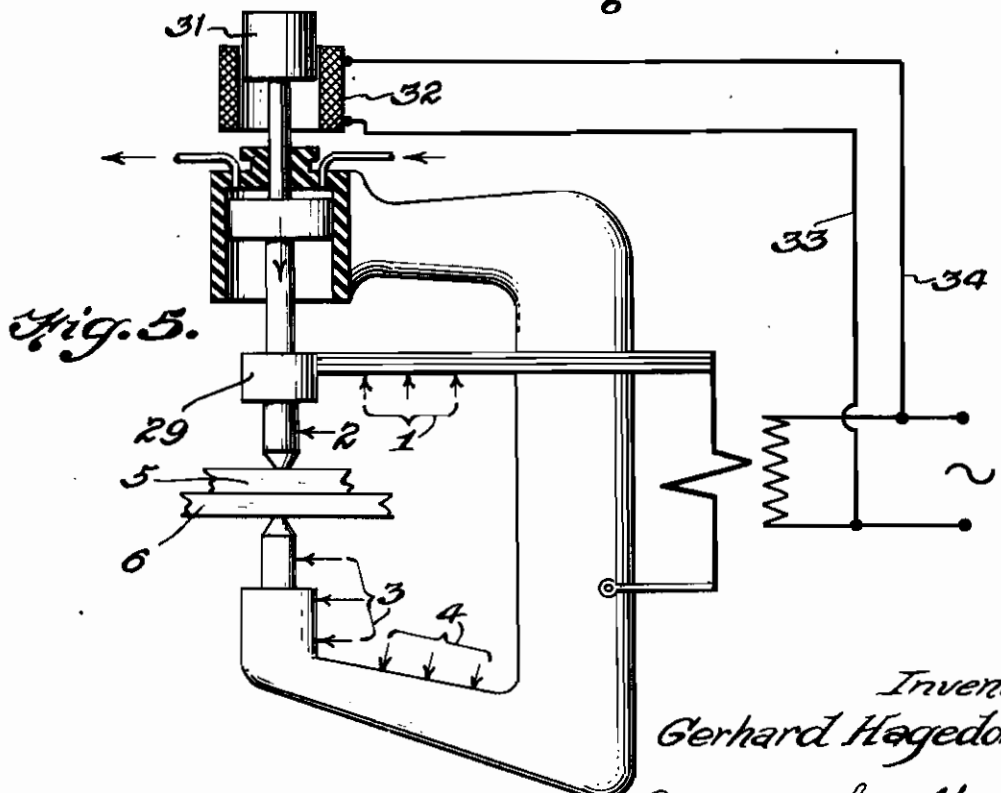

Fig. 5.

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ALIEN PROPERTY CUSTODIAN

METHOD OF AND DEVICE FOR ELECTRIC RESISTANCE WELDING

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Application filed February 11, 1941

It is known that resistance welding machines, in particular spot welding machines for light metals, carry considerable currents in the secondary circuit of the welding transformer. It has been noted, in particular in the case of light metal welding, that by these heavy currents harmful electro-dynamic forces are generated with the result that the electrodes are lifted off the work parts, though often only to a slight degree, and that at any rate the contacting pressure of the electrodes is reduced sufficient to rapidly impair the electrode area and the work parts area in consequence of the development of too intense heat of the welding current, caused by increased contact resistance. This not only endangers the corrosion-resisting quality of the welding, but also necessitates frequent replacing of the electrodes, considerably reducing the operating speed thereby. It has been endeavored to counteract such harmful forces by employing elastic means, but satisfactory results could not be obtained thereby. It has further been tried to avoid such disadvantages by making use of excessively strong contact pressures. This showed, however, that strong contact pressures entailed an extraordinary increase of the current intensity, which also had a disadvantageous effect inasmuch as the lifting off forces also showed an increase. The lifting off effect is of course diminished by the high pressure, but cannot be eliminated thereby. It is quite immaterial in this connection, whether the pressure is caused by a spring or any other pressing agent. The electro-dynamic force will continue to act, resulting in a lesser or greater acceleration of the electrode compound. These disadvantages are eliminated by the present invention.

The invention refers to a method for electrical resistance welding, characterized by the fact that for the neutralization of the electro-magnetic current forces, occurring in the secondary circuit of the welding transformer and causing the lifting off of the electrodes from the work parts, there are simultaneously generated additional electro-magnetic forces acting in the direction of the electrode pressure, compensating or overcompensating the lifting off forces. The additional electro-dynamic forces are advantageously generated by the secondary current of the welding transformer itself. But the additional electro-dynamic forces may also be generated by the primary current of the welding transformer or the source of the welding current. If the electro-dynamic forces are to be generated by the secondary current itself, the electrodes are advantageously arranged in such a manner that the electro-dynamic forces occurring in welding will press the electrodes to the work parts. In that case the elastic electrode holders, with reference to the secondary current loop, are preferably arranged obliquely toward the inside. With double-spot welding the electrode holders are also arranged obliquely toward the inside, and slidably supported at their free ends. In the case of single-spot welding an advantageous arrangement will also consist of connecting one of the electrodes with the movable part of an electro-magnet which might be fed by the current source of the welding transformer.

In the drawing the invention is represented by three modes of construction showing by

Figures 1 and 2 the distribution of the electro-dynamic forces with known welding devices for single-spot and double-spot welding,

Figure 3 a single-spot welding device with compensation of the electro-dynamic forces in the secondary circuit of the welding transformer according to the invention,

Figure 4 a double-spot welding device with compensation arrangement according to the invention and

Figure 5 a further single-spot welding device with compensation arrangement according to the invention.

With the known single-spot welding device according to Figure 1, where the electrodes are contacted by the pressure P, the electro-dynamic forces 1, 2, 3, 4, causing the lifting off of the electrode from the work parts 5, 6 and pressing them toward the outside, are indicated by arrows.

In Figure 2 are shown in a known double-spot welding device the electro-dynamic forces 7, 8, 9, effecting the lifting off of the welding electrodes, contacted by the pressure P, from the work parts 5, 6.

Figure 3 represents a single-spot welding device in which the additional electro-dynamic forces 10, 11 are generated by the secondary current of the welding transformer itself, said forces counteracting the lifting off forces 12, 13 and increasing the welding pressure P at the moment of the current impulse. The electrodes in this case are arranged in such a manner that the electro-dynamic forces, occurring in the welding operation, press the electrodes to the work parts 5, 6, this being effected, for example, by having the elastic electrode holders 14, 15, referring to the secondary current loop, arranged obliquely toward the inside.

Figure 4 represents a double-spot welding device where the additional electro-dynamic forces 16, 17 are also generated by the secondary current of the welding transformer itself, said forces counteracting the lifting off forces 18 and increasing the welding pressure at the moment of the current impulse. The electrode holders 19, 20 in this case are arranged obliquely toward the inside and with their free ends 21, 22 are slidably supported, for example, by means of the plungers 23, 24 in such a manner that the electro-dynamic forces 16, 17 press the electrodes to the work parts 5, 6. The electrodes and the electrode holders are in this instance preferably designed as small as possible. The movement of the electrode holders 19, 20 toward the inside is checked by stops 25, 26, offering but slight frictional resistance. When moving toward the outside they may rotate around a pin of the compressed air plunger sliding in the compressed air cylinders 27, 28, the contacting pressure being generated by the said compressed air plunger. Hence, they may yield to the action of the electro-dynamic forces and firmly press upon the work parts.

Figure 5 represents a further single-spot welding device with compensation of the lifting off forces. Upon the upper electrode holder 29 acts, in addition to the compressed air plunger, an electro-magnet, for example, with movable iron core 31 and rigid coil 32, whose excitation may originate from the welding current source during the time of flow of the welding current. The coil 32 of the electro-magnet is fed by way of the leads 33, 34. With this device it will be possible to compensate or overcompensate the lifting off forces.

GERHARD HAGEDORN.