Dec. 13, 1938. E. K. CLARK 2,140,348

ELECTRONIC COOKING DEVICE

Filed July 31, 1936

Fig. 1.

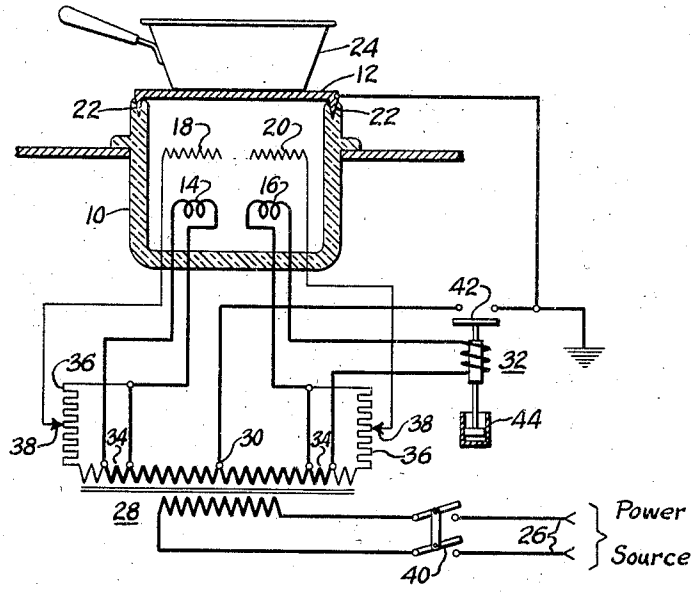
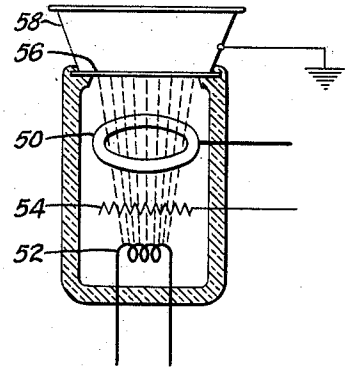


Fig. 2.



WITNESSES:

Leon J. Zaga.

C. F. Bryant

INVENTOR

Earl K. Clark.

BY

Ezra W. Savage

ATTORNEY

Patented Dec. 13, 1938 2,140,348

UNITED STATES PATENT OFFICE

2,140,348

ELECTRONIC COOKING DEVICE

Earl K. Clark, Mansfield, Ohio, assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application July 31, 1936, Serial No. 93,594

8 Claims. (Cl. 219—19)

My invention relates to the cooking of foods by electricity and it has particular relation to a new form of cooker wherein heating is effected by electron bombardment.

Generally stated, the object of my invention is to utilize a flow of electrons as the source of cooking heat.

Another object is to facilitate the adjustment of heat intensity in electrical food cookers.

A further object is to provide an electrical cooker which combines low thermal inertia with flexible adjustment characteristics.

As is known, tremendous heat may be produced by electron bombardment. The novel form of cooking device which I have devised is based upon this principle. It has the advantages of low thermal inertia, stepless adjustment of heat intensity over a very wide range, and high efficiency of energy conversion throughout this entire range.

In my new device, a top-exposed metal cooking plate is heated by a high intensity bombardment of electrons against the under side thereof. These electrons are emitted from a cathode positioned within a suitable evacuated enclosure beneath and integrally formed with the cooking plate. They may be directed against the plate either by maintaining it at a positive potential or by the use of an apertured auxiliary anode. Control of heat intensity is effected by the use of an interposed grid.

My invention itself, together with additional objects and advantages, will best be understood through the following description of specific embodiments when taken in conjunction with the accompanying drawing, in which:

Figure 1 is a simplified representation of one preferred form of my new food cooker; and

Fig. 2 is a similar representation of an alternate form of construction.

Referring to the drawing, the device depicted in Fig. 1 consists of an evacuated enclosure 10 of ceramic or other suitable material having a top wall in the form of a metal plate 12 which is adapted to support material to be cooked. Within the enclosure are positioned one or more electron emissive cathodes 14 and 16, together with cooperating grid elements 18 and 20.

The junctures 22 between the cooking plate 12 and the ceramic wall 10 are in the form of vacuum-tight seals, as are also those with the electrical conductors through which connections from the anode and grid elements are brought to the outside of the enclosure. Preferably, the enclosure is evacuated to the high degree which best facilitates the flow of electrons from the cathodes to the plate 12.

This cooking plate constitutes the anode of the specially designed thermionic device represented in Fig. 1. Through the use of suitable energizing circuits, this anode has impressed upon it a comparatively high positive potential with respect to the cathodes 14 and 16. In consequence, electrons are attracted to plate 12, and their bombardment against its under side produces a heating of intensity sufficient to cook food which may, for example, be placed in a receptacle 24.

In the circuits represented, the source of heating energy is in the form of an alternating-current circuit 26 which supplies current to the primary winding of a transformer 28. A mid-tap 30 of the secondary winding of this transformer is joined, through a control device 32, with the cooking plate 12. Preferably, this plate is grounded in the interests of safety.

To effect full-wave operation of the cooking device, the outer ends of the transformer secondary are respectively joined with the cathodes 14 and 16. Heating current for these cathodes is supplied by auxiliary winding sections 34. To supply to the grids 18 and 20 potentials which control the intensity of electron flow from the cathodes, biasing resistors 36 are arranged in the manner shown.

When the adjusting taps 38 occupy positions near the lower ends of these resistors, the grids are maintained negative with respect to the associated cathodes during the half cycles of electron attraction to the cooking plate 12. The negative charge tends to repel the electrons, and thereby minimizes the heat intensity. As the taps 38 are moved upwardly, towards positions where the grids are positive with respect to the cathodes during half cycles of electron attraction, the flow of electrons is increased and the heating intensity of the cooking device is correspondingly raised.

In this manner, the temperature adjustment is made very flexible, and substantially stepless control over a very wide range is possible without a sacrifice of operating efficiency. This feature constitutes a distinct advantage over the comparatively limited number of intensity steps which practically are feasible with other forms of electrical heaters.

To place the device of Fig. 1 in operation, the main control switch 40 is first closed. This switch may be actuated manually or may be arranged for automatic operation controlled by the presence of the food receptacle 24 upon the top of cooking

plate 12. The inherently low thermal inertia of the cooker makes the latter arrangement especially satisfactory.

If it becomes necessary to safeguard the cathodes 14 and 16 from loss of electron emissive material during the starting operation, the previously mentioned relay 32 may be included in the energizing circuit of anode plate 12. As long as transformer 28 is unenergized, contact 42 occupies the circuit interrupting position. Upon closure of main switch 40, the actuating winding of this relay is energized by a measure of one of the cathode currents. After a time delay, produced by device 44, contact member 42 is moved upwardly into the circuit closing position where it remains until transformer 28 is again deenergized.

It will be understood that the illustrated full-wave heater supply circuit represented is generally typical of all other circuits suitable for energizing my new cooking device. A half-wave alternating-current energizing circuit may also be utilized, in which case the device would require only one cathode. Likewise, the source of cooking plate potential may be unidirectional.

In Fig. 2, I have shown a modified form of construction wherein the anode 50, which attracts the electrons from the cathode 52 through a flow-controlling grid 54, is separate from the plate of heat-producing metal 56. This plate may either constitute an exposed top surface, such as shown at 12 in Fig. 1, or be in the form of the bottom of a permanently attached cooking vessel such as represented at 58 in Fig. 2.

In either case, the operation is fundamentally the same as that of the device of Fig. 1. The anode 50 is apertured in form so that a major portion of the electrons which it attracts pass on through and directly impinge upon the under surface of metal 56 producing therein the desired heating effect. The manner of control is, of course, exactly similar to that described in connection with Fig. 1.

Although I have shown and described certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the scope of the appended claims.

I claim as my invention:

1. An electrical heater comprising an evacuated enclosure having a metallic top wall adapted to support material to be cooked, a pair of electron-emissive cathodes positioned within said enclosure, and means adapted to impress upon said top metal an alternating-current potential all half-cycles of which attract electrons from said cathodes to produce a heating of the metal, said means comprising a transformer winding having a mid-tap connected with said enclosure top metal, said cathodes being respectively connected at the opposite ends of said transformer winding.

2. An electrical heater comprising an evacuated enclosure having a top wall composed wholly of a good heat conductor, the under surface at least of which is electrically conducting, adapted to support material to be cooked, an electron-emissive cathode positioned within said enclosure, and means adapted to direct from said cathode a stream of electrons against said under surface to produce a heating thereof sufficient for cooking purposes, said stream of electrons covering substantially the whole portion of said under surface corresponding to the portions of said wall that is used for cooking.

3. An electrical heater comprising an evacuated enclosure having a top wall composed wholly of a good heat conductor, the under surface at least of which is electrically conducting, adapted to support material to be cooked, an electron-emissive cathode positioned within said enclosure, means adapted to direct from said cathode a stream of electrons against said under surface to produce a heating thereof sufficient for cooking purposes, said stream of electrons covering substantially the whole portion of said under surface corresponding to the portions of said wall that is used for cooking, and means providing for substantially stepless variation of said stream of electrons thereby to provide for stepless adjustment of the heating.

4. An electrical heater comprising an evacuated enclosure having a top wall composed wholly of a good heat conductor, the under surface at least of which is electrically conducting, adapted to support material to be cooked, an electron-emissive cathode positioned within said enclosure, means adapted to direct from said cathode a stream of electrons against said under surface to produce a heating thereof sufficient for cooking purposes, said stream of electrons covering substantially the whole portion of said under surface corresponding to the portions of said wall that is used for cooking, and control electrode means in said stream of electrons providing for substantially stepless variation of said stream of electrons thereby to provide for stepless adjustment of the heating.

5. An electrical heater comprising an evacuated enclosure having a top wall composed wholly of a good heat conductor, the under surface at least of which is electrically conducting, adapted to support material to be cooked, an electron emissive cathode positioned within said enclosure, means adapted to direct from said cathode a stream of electrons against said under surface to produce a heating thereof sufficient for cooking purposes, said stream of electrons covering substantially the whole portion of said under surface corresponding to the portions of said wall that is based for cooking, and control electrode means in said stream of electrons providing for variation of said stream of electrons thereby to provide for adjustment of the heating.

6. An electrical heater comprising an evacuated enclosure having a top wall composed wholly of a good heat conductor, the under surface at least of which is electrically conducting, adapted to support material to be cooked, a pair of electron-emissive cathodes positioned within said enclosure, and means adapted to direct from said cathodes a stream of electrons against said under surface to produce a heating thereof sufficient for cooking purposes, said cathodes being so positioned that said stream of electrons covers substantially the whole portion of said under surface corresponding to the portions of said wall that is used for cooking.

7. An electrical heater comprising an evacuated enclosure having a top wall composed wholly of a good heat conductor, the under surface at least of which is electrically conducting, adapted to support material to be cooked, an electron-emissive cathode positioned within said enclosure, and an apertured anode adapted to direct from said cathode a stream of electrons against said under surface to produce a heating thereof sufficient for cooking purposes, said stream of electrons covering the whole portion of said under surface corresponding to the portion of said wall that is used for cooking.

8. An electrical heater comprising an evacuated enclosure having a top wall composed wholly of a good heat conductor, the under surface at least of which is electrically conducting, adapted to support material to be cooked, an electron-emissive cathode positioned within said enclosure, means adapted to direct from said cathode a stream of electrons against said under surface to produce a heating thereof sufficient for cooking purposes, said stream of electrons covering substantially the whole portion of said under surface corresponding to the portions of said wall that is used for cooking, and means for grounding said under surface.

EARL K. CLARK.