

Feb. 8, 1949.

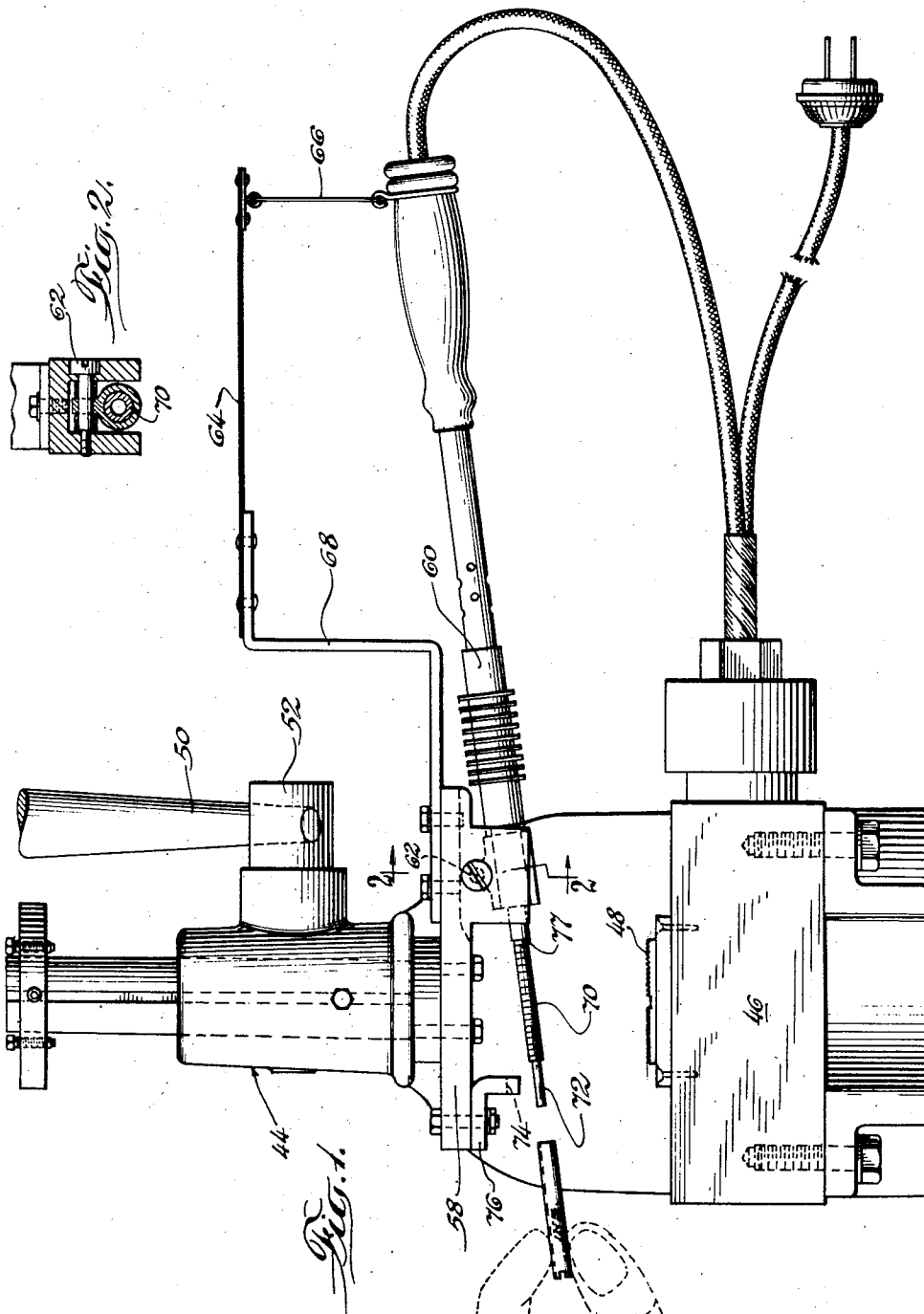
K. B. ROSS

2,461,397

PERMEABILITY TUNED TRANSFORMER

Filed June 21, 1947

3 Sheets-Sheet 1



Inventor:
Kenneth B. Ross
By *Hinkle, Horton, Adlberg, Hausmann & Kappan*
Attorneys

Feb. 8, 1949.

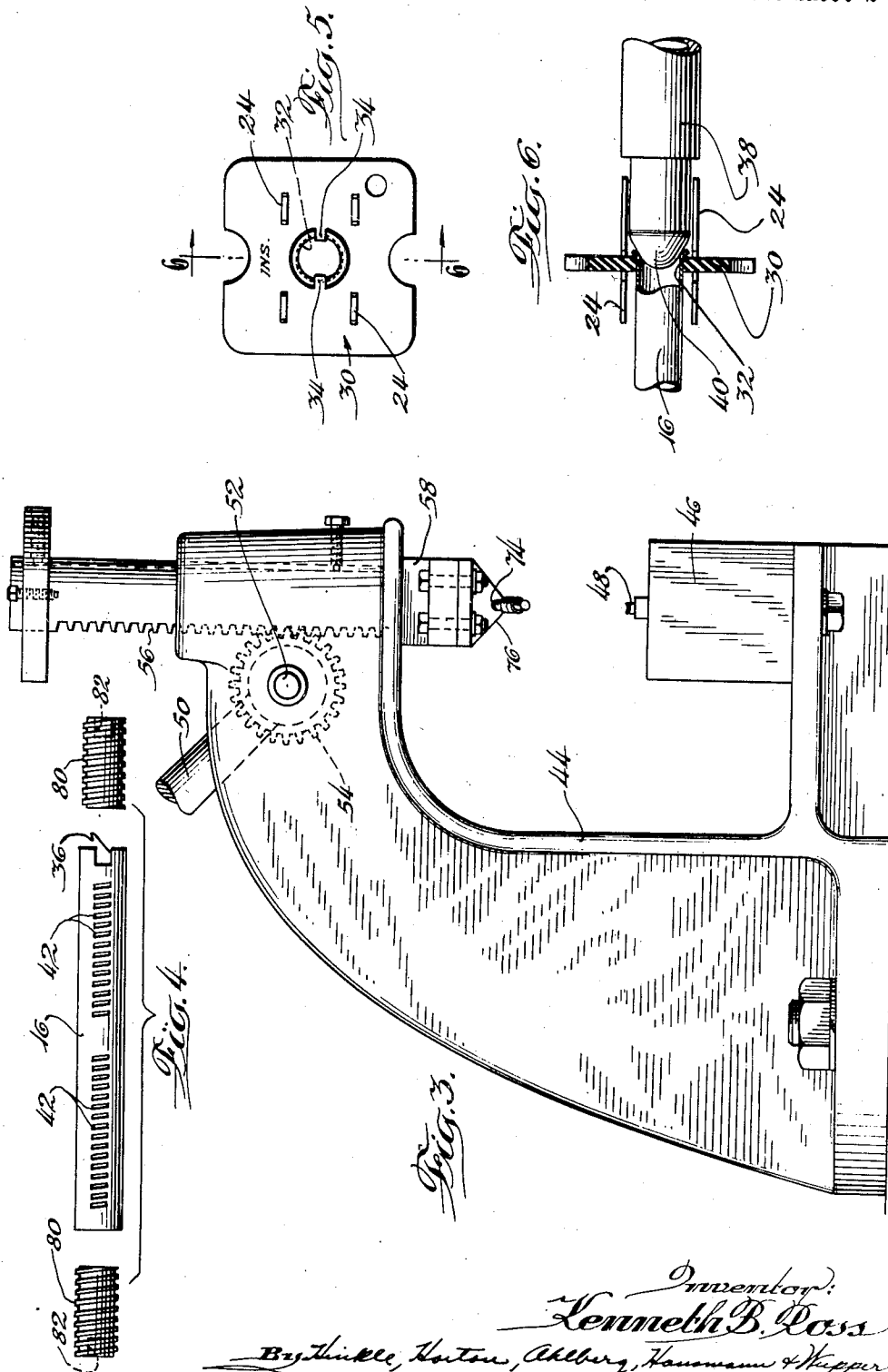
K. B. ROSS

2,461,397

PERMEABILITY TUNED TRANSFORMER

Filed June 21, 1947

3 Sheets-Sheet 2



Inventor:
Kenneth B. Ross
By *Thiele, Horton, Ahlberg, Haumann & Kipper*
Attorneys

Feb. 8, 1949.

K. B. ROSS

2,461,397

PERMEABILITY TUNED TRANSFORMER

Filed June 21, 1947

3 Sheets-Sheet 3

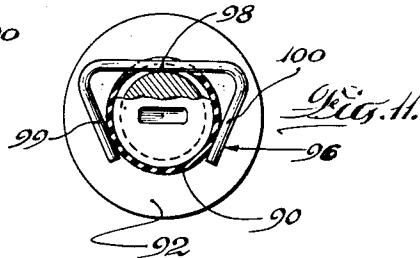
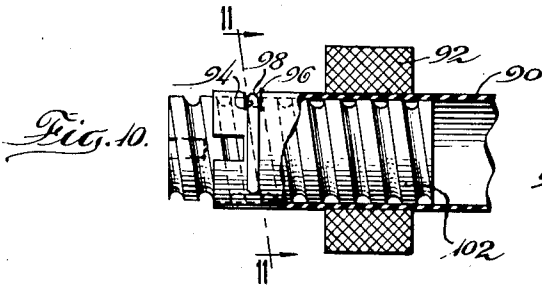


Fig. 7.

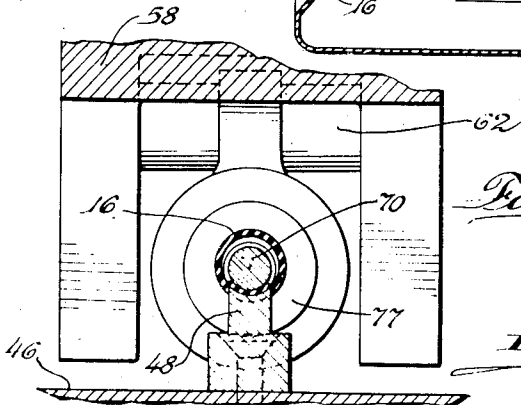
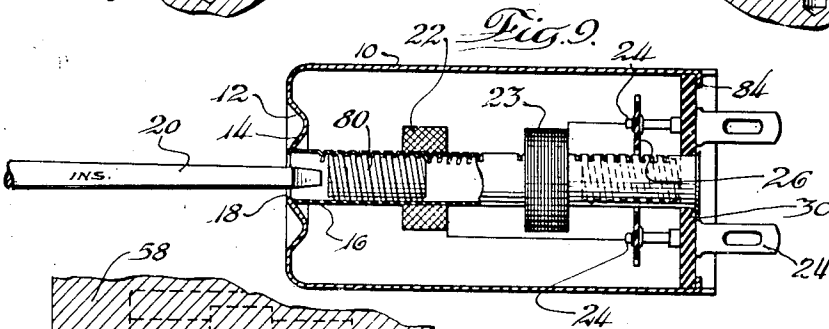
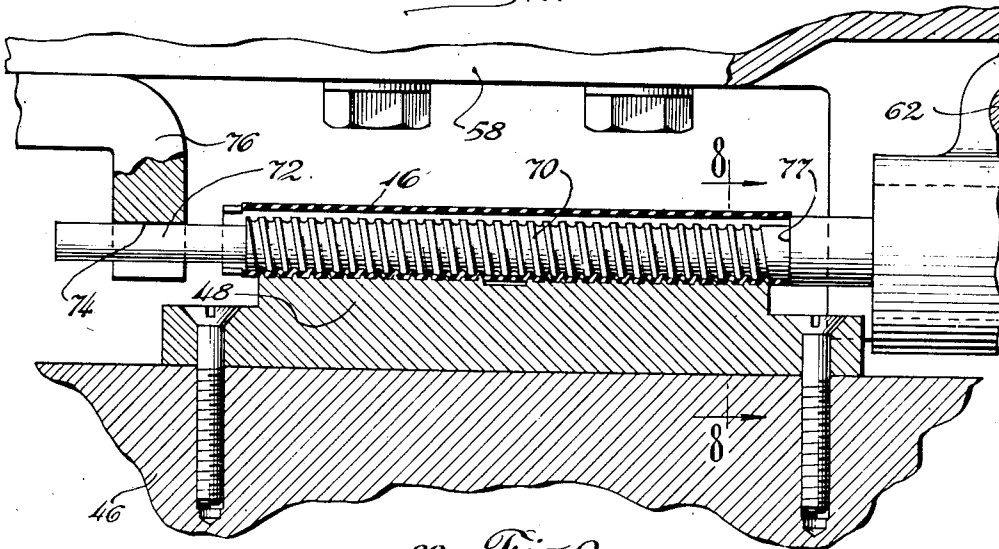


Fig. 8.

Inventor:
Kenneth B. Ross
By *Hukle, Horton, Cheary,*
Hanemann & Kupper
attorneys.

UNITED STATES PATENT OFFICE

2,461,397

PERMEABILITY TUNED TRANSFORMER

Kenneth B. Ross, Chicago, Ill.

Application June 21, 1947, Serial No. 756,281

4 Claims. (Cl. 171-119)

1

2

My invention relates generally to permeability tuned inductance devices, such as transformers, and to an improved method and machine for manufacturing the same.

It has been common in the past to provide permeability tuned transformers, such as radio frequency and intermediate frequency transformers, and oscillators for radio receiving sets and the like, with a tube or form upon which the coil or coils are mounted, and moving a pulverized iron core or cores relative to the coils by adjusting screws attached to the cores, the adjusting screws being threaded in suitable bushings secured either in the tube or in the shield therefor. This means for moving the cores in the coils had the disadvantage that the core was pressed around the adjusting screw as an insert, which increased the cost of production of the cores, and also in that the tube surrounding the core, or the shield, had to be provided with a bushing or similar threaded part, all of which contributed to high manufacturing costs.

It is the object of the present invention to provide an improved permeability tuned inductance, or transformer, in which the tube upon which the coil or coils are wound has indentations formed therein, and in which the core is externally threaded and cooperable with the indentations so as to be capable of being advanced or retracted by rotation by means of a suitable screw driver.

A further object is to provide an improved permeability tuned inductance device which is of simple construction and which may be economically manufactured.

A further object is to provide an improved machine and method for forming indentations in a permeability tuned coil supporting tube.

Other objects and advantages will appear from the following description, reference being had to the accompanying drawings, in which:

Fig. 1 is a front elevational view of the press utilized to form the indentations in the core tube;

Fig. 2 is a sectional view, taken on the line 2-2 of Fig. 1;

Fig. 3 is a side elevation of the press;

Fig. 4 is an exploded view showing the tube upon which the coils are mounted and the powdered iron cores which are adapted to be inserted therein;

Fig. 5 is a bottom plan view of the mounting plate, illustrating the manner in which the tube is assembled thereto;

Fig. 6 is a sectional view, taken on the line

6-6 of Fig. 5, and in addition showing the tool used to secure the tube to the mounting plate;

Fig. 7 is an enlarged fragmentary sectional view of the forming press, illustrating the manner in which indentations are formed in the coil supporting tube;

Fig. 8 is a fragmentary sectional view, taken on the line 8-8 of Fig. 7;

Fig. 9 is a central vertical sectional view of a complete transformer assembly;

Fig. 10 is a central longitudinal sectional view illustrating a modified form of the invention; and

Fig. 11 is a transverse sectional view, taken on the line 11-11 of Fig. 10.

Referring to Fig. 9, the transformer assembly comprises a shield can 10 which is preferably of square cross section, and is made of drawn aluminum or the like, one end of the can having an annular groove 12 which forms an internal conical surface 14 for centering the end of a tube 16 with respect to the shield can 10. The center of the grooved end of the can is provided with an opening 18 for the reception of an adjusting tool or nonmagnetic aligning screw driver 20. Transformer coils 22 and 23 are mounted on the tube 16, being secured thereto by a suitable wax or cement, the wire leads from these coils being soldered to suitable lugs 24 which are secured in an annular terminal disc 26 of mica or the like. The lugs 24 project through punched openings formed in a mounting plate 30, having a tight press fit therein.

The mounting plate 30 is preferably punched from a sheet of a suitable insulating plastic, and, as best shown in Fig. 5, has a central opening 32 and a pair of lugs 34 projecting into this opening. As shown in Fig. 4, the tube 16 has notches 36 formed in one end thereof, these notches being shaped to receive the lugs 34. The depth of the notches 36 is sufficient that the end of the tube will project slightly beyond the outer surface of the mounting plate 30, as shown in Fig. 6, this figure also illustrating the manner in which the extremity of the tube 16 is swaged by means of an electrically heated soldering iron 38 having a blunt conical tip 40 which engages and spreads the end of the tube. The tube 16 is made of a plastic impregnated fibrous material, which can be softened by the heat of the soldering iron. The tube 16 is thus permanently attached to the mounting plate 30 merely by pressing the soldering iron against the projecting end of the tube, as illustrated in Fig. 6.

The tube 16 is provided with a plurality of indentations 42 in the manner and by the means

best illustrated in Figs. 1 to 3 and 7 and 8. The hand operated press comprises a suitable frame 44. The bed of the press is provided with an electrically heated block 46 having a die 48 secured thereto in good heat conducting relationship. The press is provided with the usual operating handle 50 secured to a shaft 52, the shaft 52 having a pinion 54 thereon meshing with a rack 56 forming part of the movable head 58 of the press.

An electrically heated soldering iron 60 is mounted for pivotal movement upon a stud 62 (Figs. 1 and 2), being normally held in the position shown in Fig. 1 by a leaf spring 64 and wire link 66, the leaf spring being riveted to a bracket 68 bolted to the movable head 58 of the press. The soldering iron has a threaded die portion 70 in place of the usual tip, and has a reduced diameter end portion 72 which is adapted to engage in a notch 74 formed in a bracket 76. A stop shoulder 77 is formed at the end of threaded portion 70 to facilitate positioning the tubes.

Assuming the soldering iron 60 and the heater for the block 46 to be connected to a suitable source of current, and that the threaded die part 70 and the die 48 are heated to a suitable temperature, depending upon the character of the material of which the tube 16 is made, the operator places a tube over the threaded die part 70 with its end abutting the shoulder 77, and by means of a handle 50 brings the tube into engagement with the die 48. In the course of such movement, the reduced end portion 72 enters the notch 74 and is thus accurately positioned, so that the die parts 70 and 48 will be in alignment. By applying pressure for a brief interval of time, the heated tube is deformed to provide the indentations 42. It will be noted, particularly from Fig. 8, that the diameter of the threaded part 70 is less than the internal diameter of the tube, so that the tube may be removed easily after the head of the press is raised. After the tube has been formed in this manner, the end plate 30 is attached as previously described and illustrated in Fig. 6. Thereafter, the annular mica disc 36 is secured to the terminals 24, the coils 22 and 23 fixed to the tube, and their wires soldered to the lugs 24.

The permeable iron cores for the transformer are best shown in Figs. 4 and 9, each comprising an externally threaded pulverized iron rod 80 having a kerflike depression 82 in one thereof. The pitch of the thread on these cores 80 is identical with that of the spacing of the indentations 42 on the tube 16. The indentations 42 are of sufficient depth to engage between the threads of the cores 80 and make frictional contact therewith so that the cores are frictionally locked in any positions to which they may be adjusted, by means of an alignment screw driver 20. The cores 80 may be of any desired well known composition, such as powdered iron mixed with a resinous or similar binder and molded in a suitably heated press.

The cores are screwed into the tube 16 to the approximate position required, and the assembly of the tube 16 and plate 30 and parts carried thereby is inserted in the shielding can 10, as indicated in Fig. 9. In thus inserting the assembly, the end of the tube 16 abuts the conical surface 14 of the shield can and is centered thereby. Tabs 84 struck from the shield can 10 are turned over to hold the assembly within the can.

In using the permeability tuned inductance or transformer, the cores may be screwed inwardly

or outwardly to vary their effective permeability with respect to the coils 22 and 23, and thus vary the inductance of these coils so as to tune to the desired resonant frequency the circuits of which these coils form parts. This alignment may readily be accomplished by means of a suitable alignment screw driver cooperating with the kerf-like indentations 82 formed in the ends of the cores 80, and due to the shape of the indentations 42 which engage between the threads of the cores 80, the latter will be held rigidly in the adjusted position, even though subjected to violent vibration.

While the invention has been illustrated as being embodied in an intermediate frequency transformer, it will be clear that it may also be embodied in any appropriate circuit which is to be tuned, such as in the tuning circuit of a permeability tuned oscillator.

A form of the invention which includes many of the advantages above described, is illustrated in Figs. 10 and 11. In this construction a tube 90 has a coil 92 secured thereto, the tube 90 having a slot 94 extending transversely across approximately 60° of the periphery of the tube 90. A C-shaped spring 96 has its central portion 98 projecting through the slot 94 into the interior of the tube 90, while its end portions 99 and 100 resiliently engage the external walls of the tube 90 at points spaced approximately 120° from the center portion 98.

As best shown in Fig. 10, the central portion 98 extends into the space between the threads formed on the pulverized iron core 102 so as to press the latter tightly against the internal wall of the tube 90 and thus provide the necessary friction to retain the core in adjusted position. This embodiment of the invention shown in Figs. 10 and 11, is not quite as satisfactory as the form shown in Fig. 9, because the friction creating pressure is not applied to the core throughout its length, but only at the point where the core is engaged by the spring 96 and between the core and the opposed inner surface of the tube 90. However, it is satisfactory for use in equipment which will not be subject to severe vibration. The C-spring 96 is preferably made of bronze or similar nonmagnetic metal having high resiliency.

While I have shown and described preferred embodiments of my invention, it will be apparent that numerous variations and modifications thereof may be made without departing from the underlying principles of the invention. I therefore desire, by the following claims, to include within the scope of the invention all such variations and modifications by which substantially the results of my invention may be obtained through the use of substantially the same or equivalent means.

I claim:

1. In a permeability tuned inductance device, the combination of a coil, a tube extending through the coil and secured thereto, an externally threaded powdered iron core within said tube, said core being formed at one end for engagement by a tool for rotating the core, and internal projections forming parts of the tube and cooperating with the threads on the core to press the core against the opposed internal wall of the tube to hold it in adjusted position.

2. A permeability tuned inductance device assembly comprising, a metallic generally cup-shaped shield casing having a central tool receiving opening in one end and having a conical centering part surrounding the opening, a terminal

5

plate of insulating material closing the other end of the casing, a tube of insulating material secured to the plate and having indentations for threaded engagement with an externally threaded core, the inner end of the tube engaging and being centered by the conical centering part of the casing, an externally threaded powdered iron core in engagement with indentations in the tube and having means at its end for engagement with a tool for rotation thereby, and a coil secured to the tube.

3. A permeability tuned inductance device comprising, a tube of a plastic material having a plurality of spaced indentations, a coil secured to the tube, and a core having external threads thereon located within the tube in the proximity of the coil, the threads thereof cooperating with the indentations on the tube to cause the core to move longitudinally of the tube when the core is rotated relative to the tube, the dimensions of the parts being such that the pressure between the indentations on the tube and the threads on the core is sufficient frictionally to hold the core in any position to which it may be adjusted.

4. In a permeability tuned inductance device, the combination of a coil, a tube made of a

6

plastic impregnated fibrous material extending through the coil and secured thereto, an externally threaded powdered iron core within said tube, and means cooperating with the threads on the core, said last-named means comprising a plurality of arcuate indentations formed in the tube and spaced to engage between the threads of the core, said indentations being of sufficient depth to press the core against the opposite inner wall of the tube to provide a frictional force capable of holding the core in any position to which it may be adjusted with respect to the tube.

KENNETH B. ROSS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
863,383	Grabe	Aug. 13, 1907
2,149,848	Lampel	Mar. 7, 1939
2,297,437	Stapelfeldt	Sept. 29, 1942
2,318,415	Patzschke	May 4, 1943
2,386,732	Wohlhieter	Oct. 9, 1945