

IMPULSE GENERATOR FOR ELECTRICAL FISHING

K. SREEDHARAN NAMBOODIRI

Central Institute of Fisheries Technology (Craft & Gear Wing), Cochin-5

Since impulse current has been found to be more economical and more effective for conducting electrical fishing an impulse generator was designed and fabricated. The principle and description of the impulse generator are given in the paper. Eventhough it is not giving theoretical value of the impulse voltages it has been found that for conducting electrical fishing it is producing necessary voltages.

INTRODUCTION

Use of electricity for stunning fishes is gaining importance. In fresh water, electrical fishing can be conducted by using alternating current or direct current. Since the sea water is 500 times more conducting than fresh water, it is not economically possible to use AC and DC for fishing. So impulse current has to be used for this purpose. Further impulse current has the following advantages over the other types of currents.

1. With a proper wave form, the impulse current is more effective than other types.

2. Since the reaction of a particular species of fish of a particular size group depends on a particular impulse rate, selective fishing is possible using impulse current.

3. The power required for producing the same effect is much less than the other types of currents.

So for conducting investigations on electrical fishing an impulse generator was designed and fabricated in the Institute. This paper deals with the principle and working of the impulse generator.

PRINCIPLE

The Principle adopted is that given by Meyer-Warden (1957). When a condenser is charged for a short time by direct current and is subjected to discharge, it will give an impulse type of pulsating current. The circuit diagram in Figure-1 explains the principle of the impulse generator.

A condenser C is connected through a resistance R to a battery of voltage E by means of a reversible switch S.

Let the voltage across the condenser C 't' seconds after switching over to 'a' position be 'v' volts and the corresponding charging current be 'i' amperes. Let the voltage increase from V to (v + dv) volts in dt seconds.

Then we have $i = C \frac{dv}{dt}$ and the corresponding potential drop across

$$R \text{ will be } Ri = RC \frac{dv}{dt}$$

E = voltage across C + voltage drop in R

$$= v + Ri = v + RC \frac{dv}{dt}$$

$$\text{i. e. } E - v = RC \frac{dv}{dt}$$

$$\text{Therefore } \frac{dt}{RC} = \frac{dv}{E-v}$$

$$\int \frac{dt}{RC} = \int \frac{dv}{E-v}$$

i. e. $\frac{t}{RC} = -\log_e (E-v) + A$ where A is a constant.

When $t = 0$ $v = 0$

Therefore $0 = -\log_e E + A$ i. e. $A = \log_e E$

$$\frac{t}{RC} = -\log_e (E - v) + \log_e E$$

$$= \log_e \frac{E}{E - v}$$

$$\text{i. e. } \frac{E}{E - v} = e^{t/RC}$$

$$E = e^{t/RC} (E - v)$$

Therefore voltage across the condenser after 't' seconds

$$v = \frac{E (e^{t/RC} - 1)}{e^{t/RC}} = E (1 - e^{-t/RC})$$

$$\text{Charging current } i = C \frac{dv}{dt}$$

$$= CE \frac{d(1 - e^{-t/RC})}{dt} = \frac{E}{R} e^{-t/RC}$$

At the instant of switching on $t = 0$

$$e^0 = 1$$

Initial value of charging current for one

$$\text{condenser} = \frac{E}{R}$$

If N condensers are being charged in parallel total initial current drawn from the source = $\frac{NE}{R}$ amps.

After the condenser is charged let the switch S be put on to the position (b). Now the condenser is disconnected from the battery and is allowed to discharge through the resistances (R + r)

Suppose N condensers are connected in parallel and charged from a DC source for 't' seconds. Then the condensers are connected in series. The theoretical value of the impulse voltage available at the terminals will be = $NE (1 - e^{-t/RC})$

The initial discharging current when the terminals are connected across a resistance (R + r) = $NE \frac{(1 - e^{-t/RC})}{R + r}$

Thus the amplitude of impulse voltage that is available from a generator having N condensers will depend upon the charging voltage and the time of charging.

DESCRIPTION

A schematic diagram of the impulse generator is shown in Figure-2. It consists of a rotor made of wood. The rotor contains a number of contact strips which are internally connected. Four condensers of 1000 microfarads are used in the generator. The condensers are connected to the rotor by means of carbon brushes. In one position of the rotor the condensers will be connected in parallel to a DC source by means of carbon brushes. In the other position the condensers will be connected in series and the impulse voltage will be obtained from the terminal leads. The rotor is driven by a petrol engine.

For every rotation the condensers are charged and discharged twice. So the impulse rate for a particular RPM of the

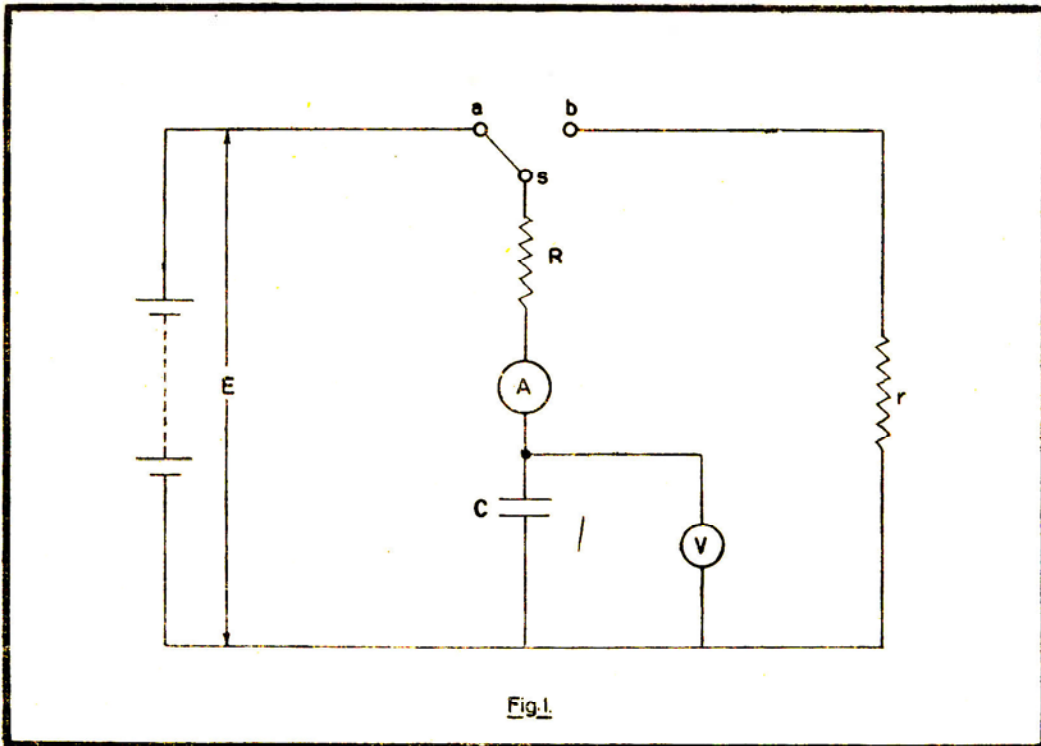
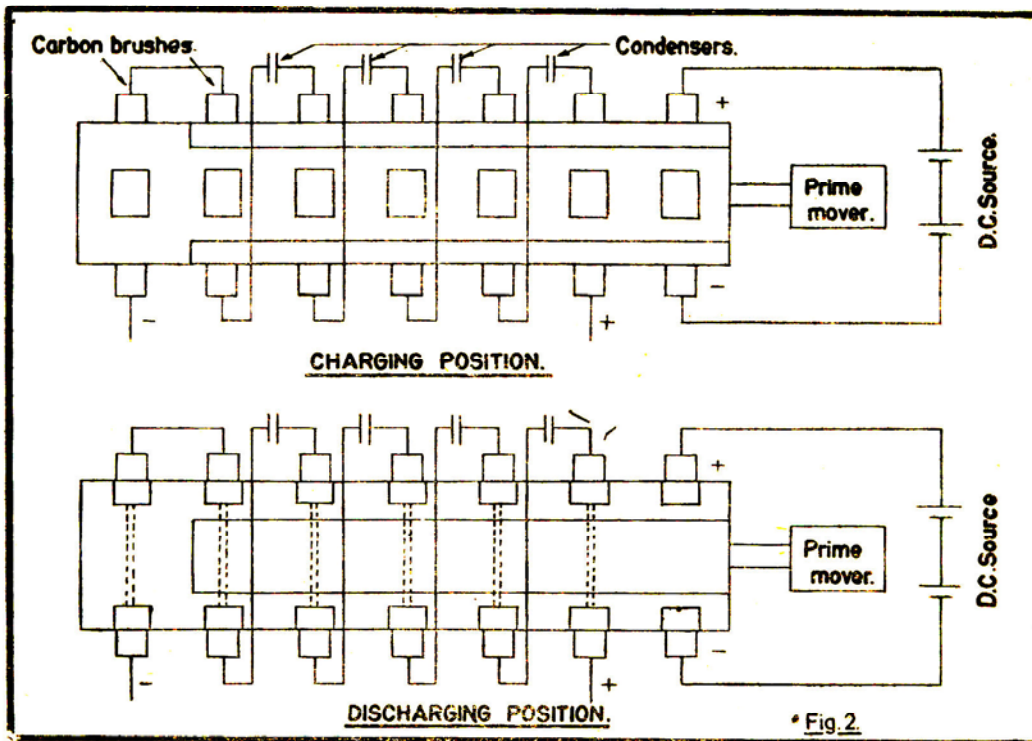


Fig. 1.



* Fig. 2.

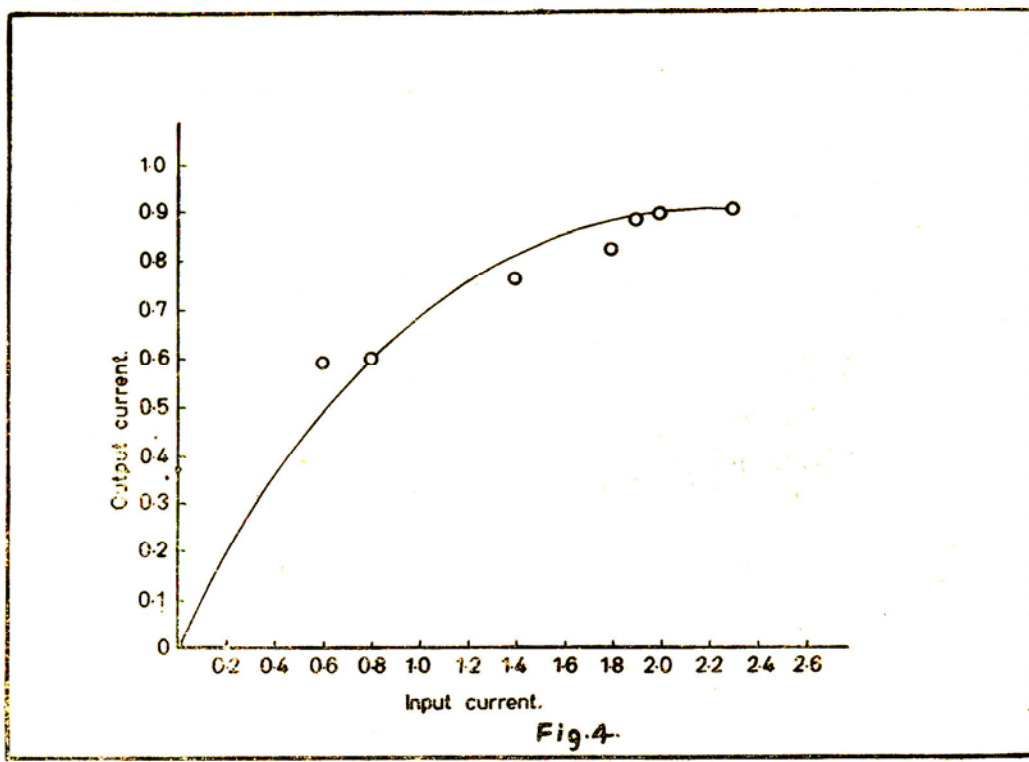
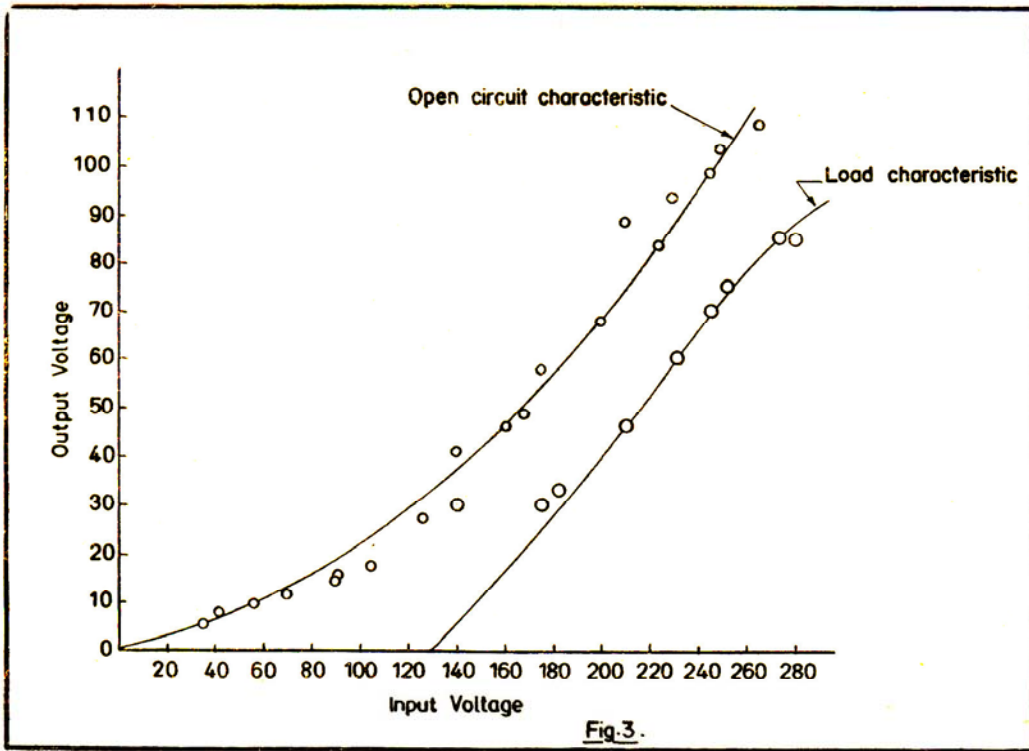


TABLE I SHOWING THE OPEN CIRCUIT CHARACTERISTICS OF THE IMPULSE GENERATOR WHEN RUN AT 1000 RPM

Input Voltage	Output Voltage	Input Current
35	6	0
42	8	0
56	10	0
70	12	0
91	16	0.6
105	18	0.6
126	28	0.6
168	50	0.6
175	59	0.6
200	69	0.6
224	85	0.6
230	95	0.6
245	100	0.6
250	105	0.6
266	110	0.6
280	110	

TABLE II SHOWING THE LOAD CHARACTERISTICS OF THE IMPULSE GENERATOR RUN AT AN RPM OF 1200

Input Voltage	Output Voltage	Input Current	Output Current
70	—	—	—
85	—	—	—
100	—	—	—
112	—	—	—
128	—	—	—
140	30	1.4 A	0.6
175	30	1.4 A	0.6
182	33	1.4 A	0.6
203	47	1.5	0.8
210	57	1.6	0.82
231	60	1.65	0.83
245	70	1.8	0.84
252	75	1.8	0.84
260	80	1.9	0.88
273	85	2.0	0.89
280	85	2.3	0.9

generator can be obtained by Multiplying the RPS of the rotor by two.

DISCUSSION ON CHARACTERISTICS :

Table I shows the open circuit characteristics of the impulse generator when it is run at an RPM of 1000. The actual output voltage obtained from the generator is much less than the theoretical value because there are so many voltage drops occurring in the circuit. The carbon brushes of the rotor are the main sources of voltage drops in the impulse generator. The open circuit characteristics is drawn in Figure 3.

From this it is seen that for lower value of input voltage the relation is almost a straight line. But as the input voltage is increased beyond 220 V the relation is no more straight line and there follows drooping characteristics.

Table II shows the load characteristics of the generator. The relation between input voltage and output voltage is shown in Figure 3.

From this it is seen that in the earlier stages whatever impulse voltage is generated it is lost as voltage drop in the load. If the input voltage is increased beyond 130 the relation between input and output voltage is almost a straight line and as the output voltage reaches 90 no more increase for any additional input voltage is observed.

The relation between input current and output current does not follow any straight line relation (Figure 4)

ACKNOWLEDGEMENT

The author wishes to express his sincere thanks to Shri M. Velu, Research Officer (Mechanical Engineering) for giving useful suggestions during the work and for going through the manuscript and also to Dr. A. N. Bose, Director for the encouragement in carrying out these experiments.

REFERENCE

Meyer - Warden P. F., 1957. Electrical Fishing, F.A.O. Fisheries Study No. 7.