Research Inventy: International Journal Of Engineering And Science
Vol.3, Issue 6 (Aug 2013), PP 14-18
Issn(e): 2278-4721, Issn(p):2319-6483, Www.Researchinventy.Com

Blood Flow Monitoring Through Human Brachial Artery With The Help Of Oscilloscope By Indirect Method

[1]santosh Kumar Nath, [2]sandip Kumar Nath, [3]raju Basak, [4]d.P Chakraborty
[1]Professor and H.O.D.Electrical engineering Department, Calcutta Institute of Technology, uluberia, Howrah-711316.
[2]Medical Officer ICU at Bharat Sevashram Sangha Hospital
[3]Research Scholar, 113/3, Dakshindari Road, Dinesh apartment, Flat – A2/4, Sreebhumi, Kolkata – 700 048
[4]Dean of Faculty, Calcutta Institute of Technology, uluberia, Howrah-711316.

ABSTRACTS: *The pattern of blood flow and detection of the same with the help of oscilloscope by indirect method through human brachial artery is the separate approach for reducing time of the treatment in medical science. The Physicians used to measure the blood Pressure by using Pneumatic Cuff encircling the upper arm of the patient. An inflatable section of this Cuff is inflated by a small hand pump and the blood Pressure is released after measuring the exact pressure. The Cuff is inflated to a Pressure greater than blood Pressure in the large brachial artery and Cuts off blood flow through brachial artery of the arm. This squirting blood results a display by an oscilloscope. This flow of blood through brachial artery of the human body will be detected with help of Pressure Transducer (Piezoelectric Transducer) similar to the Transducers used for direct Pressure measuring device. Any physician can estimate the condition of the blood circulation through the heart of the patient as well as the blocked passage of the vein/artery connected to heart of the patient by using an oscilloscope as a display device or using Monitor. Physician can detect primarily the heart condition of the patient. This type of special equipment can be helpful to cope up with the modern treatment.*

KEY WORDS*: Monitoring, Indirect method, Blood flow through brachial artery, Oscilloscope.*

I. INTRODUCTION

It is the indirect measurement of blood flow with the help of Transducer through the brachial artery /vessel/heart. The blood flow through the brachial artery will be detected by the magnetic flow meter and the flow will be displayed through the oscilloscope. The blood flow meter is based on the principle of magnetic induction method, when an electric conductor is moved through a magnetic field a voltage is induced in the conductor which is proportional to the velocity of its motion. The method is applied where the moving conductor is not a wire, but a conductive fluid which flows through the brachial artery located in the magnetic field. The vibration sensor used consists of semiconductor type strain gauges having a gauge factor of 162.

The strain gauges are differentially placed on the vibrating surface of the vibration sensor for measuring vibration of the brachial artery. The Pre-amplifier consists of 50 Hz notch filter connected in series with a band pass filter (200 Hz to 400 Hz). These circuits incorporate the operational amplifiers made of I.C. chips.

The output of the pre-amplifier is connected to buffer for connection to the audio amplifier, the output of which is subsequently connected to the respective output of the device such as speaker, C. R. O. and display device. The block diagram of a magnetic blood flow meter is shown in the Fig 1. A case study is considered involves 3 nos. of patients is given out of 30 at the end of he paper in tabular form. The direct and indirect both the method is applied to each of the patient with an objective to show the direct method can be easily replaced by indirect method with an added advantage of detection of blockage.

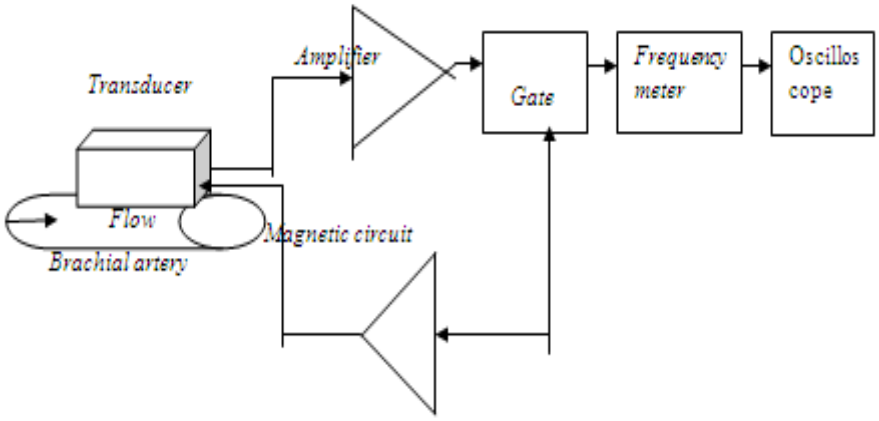


FIG: 1

BLOCK DIAGRAM OF A MAGNETIC FLOW METER

II. METHODOLOGY

The Cuff is inflated by a pressure in the large brachial artery on the human arm. Pressure thus collapses the artery and cuts off blood flow through the arm. As the pressure in the Cuff is gradually released through a release valve operated by the hand pump, a point is reached where the Cuff pressure and the peak of Systolic arterial pressure are the same. At a pressure slightly below the level of peak arterial pressure when slightly exceeds the Cuff pressure and blood is squirt through the compressed segment of the brachial artery. The squirting blood results a turbulence within the artery creating sounds known "Korotkov`` sound. These sounds are usually detected with a Stethoscope placed over the brachial artery on the arm. As the pressure is further decreased, Korotkov sounds continue until a point is reached where no further turbulence is produced. This point represents the Diastolic blood pressure. As it is some what difficult to detect the pressure where the Korotkov sounds begin and cease, this Sphygmomanometer technique can not be relied upon to produce an accuracy of much better than about 10 millimeters of mercury. The technique is inaccurate though it is simple to perform and very little discomfort is felt by the patients. This method can be replaced by using an oscilloscope, Digital display device and loud speaker to measure indirect blood pressure may be conveniently recorded, this system is shown in the Fig: 2. It is in addition of the previous the block diagram of Fig: 1.

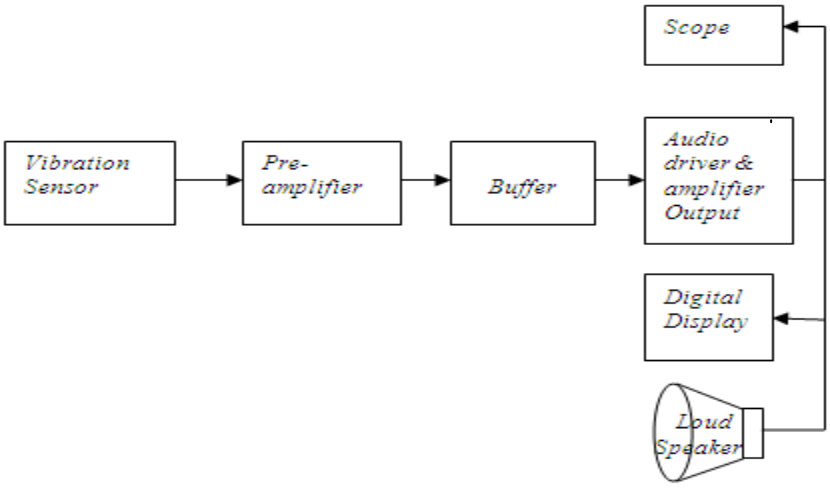


FIG: 2 SCHEMATIC REPRESENTATION OF THE CIRCUIT

The vertical channel of an oscilloscope displays the output in the form of a Korotkov sound, while the horizontal channel displays the output from a pressure transducer. A typical display produced by this system is also shown in the Fig – 3.The horizontal axis is calibrated by pressure; the points at which vertical information appears and disappears are the Systolic and Diastolic pressure respectively. The system having some what greater accuracy rather than the conventional measurement, as it replaced the human judgment by Korotkov

sound. In some cases the clear display has been obtained by rejecting the unwanted information from the microphone.The 150 Hz frequency is introduced to a high pass filter placed between the microphone and the oscilloscope vertical channel. The prime frequency contained the information appears having range of 200 Hz to 400 Hz.

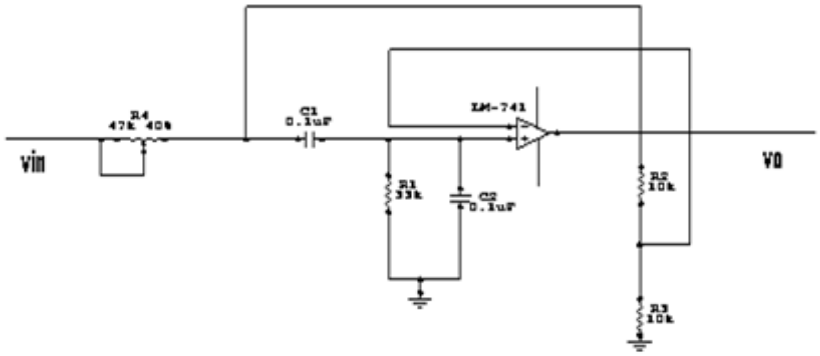
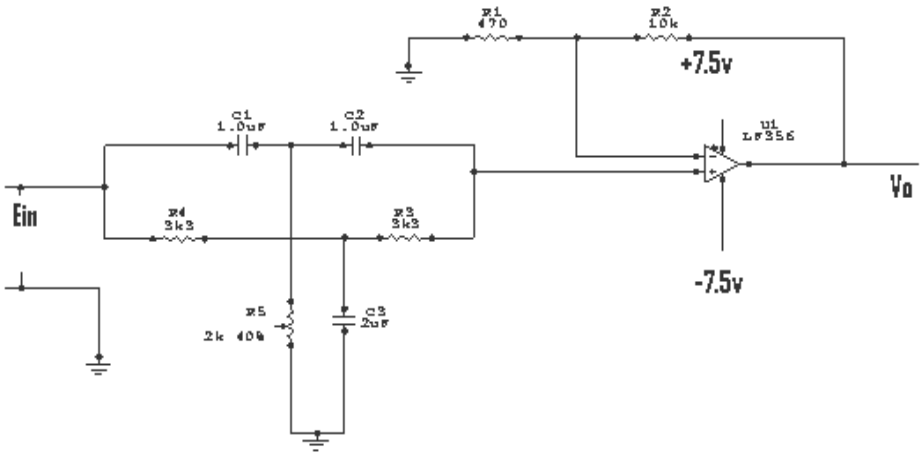


FIG: 3 PRE- AMPLIFIERS CIRCUIT

Fig: 3, show pre-amplifier circuit. The IC LM- 741 is used in the circuit. The function of the pre-amplifier circuit is to amplify the signal which is obtained from transducer and eliminates the noise at the same time. The signal obtained from this section is also given to the amplifier output stage through the volume control.

In order to reduce the interference of the power line pick up a rejection filter at 50 cps is necessary for the ECG instrument. In the present work a rejection filter with twin – T network has been designed. This active filter forms an integral part of the ECG instrument. The circuit diagram of the twin-T filter is shown in the Fig: 4.



.

FIG: 4 THE CIRCUIT DIAGRAM OF THE TWIN-T FILTER

The transfer function of the twin –T network is given

$$\frac{E_O}{E_{in}} = \frac{1 + (RCS)^2}{(RCS)^2 + 2CS + 1}$$

Where, R = Value of the resistance;
C = Value of the Twin - T network capacitance;
S = Jw;
E_O = Out put voltage of the Twin – T network;
E_{in} = Input voltage of the Twin – T network.

If the amplifier gain is K, then the output voltage E_0 of the active filter Will be

$$E_o = E_{in} \frac{K[1 + (RCS)^2]}{(RCS)^2 + 2CS + 1}$$

Present design Values are

K = 20, R = 3.3 Kilo – ohm, C = 1.0 micro- farad

III. CASE STUDY AND RESULTS

30 Nos. of male and female patients with their age group between 28 years to 46 years are examined. These patients were no hypertension, hypertension and diabetic. Only three results out of 30 Nos. of patients are furnished in the Table. All patients discontinued their medicine for 3- days before the study. They have no cardiovascular diseases and their clinical investigations were normal. The direct and indirect reading is compared to draw the final conclusion. While measuring the blood pressure the Cuff and Sensor are placed on the arm.The Sensor is fastened with the skin by adhesive plasters so that they can make a good contact with the skin without slipping over the skin surface. Finally the measurement is carried out by direct and indirect methods.

Name of the patient	Age	Direct Reading	Indirect Reading
T.K. Roy (Case-1)	28 years	B.P. 130/70	B.P. 135/70
G.B. Jana (Case-2)	45 years	B.P. 160/90	B.P. 168/88
A.Sengupta(Case-3)	46 years	B.P. 165/90	B.P. 168/68

IV. CONCLUSION

The conclusion can be made about the equipment is the detection and recording of Korotkov sound corresponding to Systolic and Diastolic blood pressure. Korotkov sound is not found in the conventional method for measuring the blood pressure with the help of Sphygmomanometer device. The added advantage of the device is that, it is capable to record the important aspects of Korotkov sound pattern corresponding to blood flow through human brachial artery by which Physician can easily investigate the actual causes of the disease. Time consuming manual measurement can be replaced by the device which will be beneficial for the Doctors to treat the patient faster.

REFERENCES

[1] AAMI, Medical Instrumentation series 103, blood pressure measurement: *A comparison in Techniques;*

[2] *Guide to Physiological pressure Monitoring*, Hewlett-Packard Company 1978 (Part No. 5952-5237).

[3] *Recommendations for human blood pressure Determination by Sphygmomanometers*, New York: American heart Association,1967;

[4] Geddes L.A. *The direct and indirect measurement of blood pressure*, Chicago. Year book Medical Publishers, Inc 1970.

[5] Franklin, D. L. *Techniques for measurement of blood flow through Intact vessels*, Medical Electronics and Biological Engineering, 3(1965) 27-37.

[6] Burch, G. E. and N. P. Depasquade, *Primer of Clinical Measurement of blood pressure*. St. Louis Mo. The C.V. Mosby Company, 1962.

[7] Bartholomew, D. *Electrical Measurements and Instruments*, Boston, Allyn and Bacon. Inc, 1963.

[8] Benchimol,.*Non-Invasive Diagnosing Techniques in Cardiology*, Baltimore. Md. The Williams and Wilkins Company,1977.

[9] Brazier, M. A. B. *The Electrical Activity of the nervous system*, Baltimore, Md. The Williams and Wilkins Company, 1968.

[10] Chowdhury J. K, Bhattacharyya S. N, Basak T. K, Pandit A. K, "*Electronics Simulation of Transmission of Signals through Basilar Membrane* `` IE (India) Journal –IDGE, July, 30.1977.

[11] Yanof H. M, *Biomedical Electronics*, 2nd edition Philadelphia, F. A. Davis Co. 1972.

[12] David A. Paulus '*Non- Invasive blood pressure measurement* ` Medical Instrumentation, Volume – 15, No.-2, 1981.

[13] Ramsey Maynard' *Non-invasive Automatic Determination of mean arterial pressure*, Medical & Biological Engineering and Computing, 1979, 17.

[14] Yelderman, M, Ream A.K, *Indirect measurement of mean blood pressure in the Anaesthetized patient Anesthesiology*, Volume – 50, No.-3, 1979.

[15] Graven stein J. S, New bower R. S, Ream, A. K, Smith N. T. –*Essential Non- Invasive Monitoring in Anesthetics – Grune & Stratton*, 1980. IS No.0-8089-1241-0.

[16] *Sphygmomanometers–Principles and Precepts*. Copiague, N.Y.W.A. Baum Co. 1965.

BIBLIOGRAPHY

[1]Santosh Kumar Nath was born in 1945. He obtained his BEE degree in 1979 and M.E.E. degree in 1987 **from** Jadavpur University. He obtained his Ph.D. degree from Moscow in 2003. He is a Fellow of the Institution of engineers (India) and Fellow/Member of several organizations of prime importance .He has served as Asst./Deputy Director at Govt.organizations and as faculty member/Principal at several private engineering colleges viz. Dream Institute of Technology,Kolkata, Global Institute of Management and Technology, Krishnager, Nadia, etc. His area of specialization is bio-medical Instrumentation, Electrical Lay-out and illumination design. He has authored many books and papers. At present he has been working as Professor & HOD, in the Electrical Engineering Department of Calcutta Institute of Engineering, Uluberia, Howrah.

[2] Sandip Kumar Nath was born in 1974. He obtained his MBBS degree **from** Calcutta University in 2001. Registration Number WB-58029 of WBMC.Medical **Officer** in "Behala Balananda Brahmachari Hospital and Research Centre", Diamond Harbour Road, Behala, Kolkata, **Resident Doctor** in "Apollo Gleneagles Hospital", Kolkata-700054, as **Medical Officer** in "MedicareTPA Services" of 6, Bishop Lefroy road, Kolkata-700020, at present he has been working as Medical Officer ICU at Bharat Sevashram Sangha Hospital.

Raju Basak was born in 1972. He is working in the Geological Survey of India since 2001. He obtained his M. Tech. degree from West Bengal University of Technology in Electrical Devices and Power System in 2009. His field of interest includes electrical machine design and control engineering. Now he is pursuing his research work at Jadavpur University. He has to his credit three published papers. Mr. Basak is a corporate member of The Institution of Engineers (India).

Prof. (Dr.) D.P Chakraborty, presently Dean of Faculty of Calcutta Institute of Technology, Uluberia, Howrah. He got his B.E. degree from Jadavpur University and an M.E. degree from Bengal Engineering & Science University (BESU), Howrah and a PhD degree in Engineering from Jadavpur University.He has written a nos. of technical papers and guided several nos. of PhD students. Formerly he was a Professor and Head of the dept. of Electronics & Telecommunication Engineering at BESU (Bengal Engineering & Science University).