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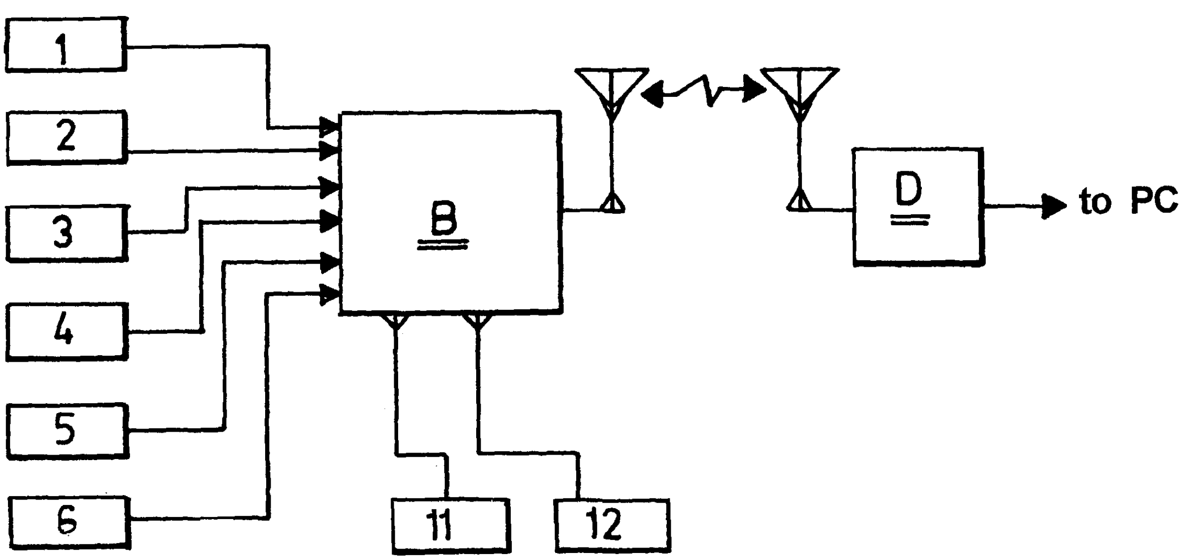
(54) A device to optimize the yield of oil wells

(57) A device which optimizes the yield of oil wells characterized by a piston stroke sensor (1) capable of measuring the parameters of the pump piston, a dynamometer (2) which shows performance and power used by the pump, a flowmeter sensor (3), a sensor which controls the operation parameters of the performance of the power engine (4), a degree of acidity gauge (5) of the extracted fluid, a degree of viscosity gauge (6), a salinity monitoring assembly of the extracted oil, a pressure and level fluid between columns sensor and a gas detector, all of them connected to the well monitoring assembly which processes the received data and which is connected to the monitoring base (D).

FIG.1



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Description

[0001] The present invention refers to a device to optimize the yield condition of oil wells and more precisely a device for the efficient control of oil extraction from oil wells.

[0002] At present certain parameters inherent to the correct functioning of production oil wells are obtained manually, making the former be obtained discontinuously. This is due to the fact that the instruments used for such purpose are of the portable kind, compelling the measurement at the respective well site with adequate equipment, and trained staff for its use. This practice, which bears a significant cost, is therefore performed sporadically, allowing for information gaps between one measurement session and the next, since there are no means of providing information of well ongoing performance. Therefore, in case of an anomaly, measurement losses cannot be corrected promptly in due time and form.

[0003] Such measurement loss, though minimum in some cases, accumulated through time may become significant.

[0004] See some examples below:

[0005] If the pump is working at an adequate pace, at a piston stroke difference of about 2,50%, and taking into account the number of piston strokes per minute, (with an average of six), this translated into hours, days, and months, amounts to a significant result. Considering that the control session is normally performed every 90 days, the extent of the production loss of the well can be assessed as well as the unnecessary power expenses incurred into.

[0006] When the pump drive engine is of the electrical type, failures in the energy supply, such as the lack of tension in a phase or inadequate voltage will make, in the best of cases (if a preventive device has been implemented) the engine stop working. Such a problem, at present can be visually detected, or when a significant decrease is located in the storage plant or pumping system, in the case any of these existed.

[0007] At present, the relation oil, water and gas is measured in the area of the oil well, by attending the well area with a voluminous instrument, which is transported by means of heavy or weighty equipment, which makes the measurement sessions of these parameters become distant along time (due to significant costs), producing some uncertainty about the information obtained. This does not allow for a factual projection of yield quality.

[0008] Today the analysis of the productive capacity of the area is done in an uncertain manner since the means of acquiring this information does not provide in due time and form the necessary elements to perform it accurately. This lack of information not only produces some uncertainty about the production results at present but also an irrational exploitation of the resource, reducing its productive potential through time. This carries with it an anticipated reduction in the yield of its different productive forms.

[0009] The examples above are some of all the parameters that should be taken into account for an optimum yield since they are not performed due to both the absence of adequate technology and the expense arising from the problems caused by the lack of adequate instruments.

[0010] The analysis of the factors which affect production at present, together with the need to improve production output, have led together with new technologies, new sensing instruments and the use of digital and computer techniques, to the invention of an instrument capable of sensing and sending the corresponding data to a base the location of which can be in the well area or outside it, without any limit as to distance. From it, data of the operation of different oil wells in the oil field can be obtained at all times, making it possible to proceed at considerable speed to keep production losses to a minimum and also to improve on output, by the crossing of the data required sent by the sensors, enabling a thorough and exact analysis, applying the adequate connections.

[0011] This innovation is based firstly on the design of new sensors and secondly on the use of computer assisted data transmission. To achieve the first stage of this project, sensors operated by robotics were created at a reasonable cost. That is to say, together with their low cost, their comparatively small size, in case there existed some other instrument which could be used likewise at present, in a natural manner, the value added to these is that they do not require human assistance since this technology makes them operate automatically. These sensors increase the amount of measurement parameters significantly, since many of the kind lack adequate measurement instruments.

[0012] The essential object of this invention is the device which optimizes the yield of oil wells, the novelty of which consists of a piston stroke sensor capable of measuring pump piston (plunger) parameters, a dynamometer that indicates the performance and power used by the pump, a flow measuring sensor, a sensor to control the performance parameters of the engine, a degree of acidity of output flow sensor, a degree of viscosity sensor, a salinity control device of the extracted oil, a pressure and level of fluid between columns sensor and a gas detector, all of which are connected to a well control device which processes the received information and which is connected to a monitoring base.

[0013] In the preferred embodiment of this device the said piston stroke sensor includes a data emitting device on the number of piston strokes in fractions of 1/20 in a minute.

[0014] In this preferred embodiment of this device the pH or acidity degree sensor includes a circuit that verifies the acidity degree together with the temperature at the time of the measurement.

[0015] In the aforementioned mode of the device the flowmeter sensor contains an element which produces a magnetic signal and not a mechanic one.

[0016] Both the main object of this invention and its advantages could be better seen from the following description of its preferred embodiment, with reference to the drawings, in which:

[0017] Figure 1 is a diagram (in a block) of the designed device; and figure 2 (comprising partial figures 2a-2b) is a diagram of a section of the circuit of the device.

[0018] As can be observed in the block diagram figure 1 the instrument is made up of basically a series of sensors connected to a processor assembly B in the data sending mode to the mentioned above and a couple of well monitoring elements connected to the outlet of such processing device.

[0019] Also, the processor B assembly is connected to a radio-connected monitoring base D, where all the operational data of the oil field are stored in a PC.

[0020] Piston stroke sensor 1 provides the information of the number of piston strokes in fractions of 1/20 in a minute, thus reporting stroke length and time.

[0021] The sensor of dynamometer 2 emits data on pump performance and power used by it.

[0022] This provides data for two diagrams, one without valve checking and another one with the checking of such valves, its operation being totally automatic. For the pump at the exact point of the several valves and the time needed to avoid the destabilization of the oil well. As it is done in a programmed fashion, time is significantly shortened compared with the manual methods used at present.

[0023] The flowmeter sensor 3 emits a magnetic signal, not a mechanic one, which enables with the least effort, not affecting in this way, the median flow level. The information is transmitted to monitoring base D every hour, and can be synchronized with all the wells of the oil field. In this way any operation that could be made and which affects the area could be observed, mainly those related to injection wells in areas of secondary recovery.

[0024] The engine power control sensor 4 provides data that are transmitted to the base and is formed by the following parameters: voltage, current, cosine ø. This sensor has an alarm system, and in the event that the critical programmed points were surpassed, enables monitoring base D to take the necessary steps before attending the well area to see to the problem and to learn that the well stopped at the time this happened.

[0025] The multiple sensing assembly 5 includes:

a) The pH or degree of acidity sensor 5 checks a parameter that is normally tested in a laboratory, but in order to avoid this, the present device implements a new and automatic system which provides the degree of acidity together with the temperature at the time of the measurement.

b) Salinity monitoring, which provides exactness through time, since emphasis has been laid on a self-preservation system for used electrodes;

c) A self-potential gauge sensor;

d) A temperature fluid sensor used at the moment of the measurement;

e) A fluid pressure sensor, sensing that is done in the production pipe next to the wellhead to have an effective control of its level, and adapt it to the yield rate values compatible with the capacity of the oil field, preventing it in this way from reaching very low levels which could affect the output of the oil field in the future; and

f) A gas detector sensor, with which the presence of gas can be measured; together with the pressure allowing to draw the volume of gas obtained.

[0026] With the oil viscosity sensor 6 the measurement is done automatically with oil samples previously separated from the gas and the water which it could contain at the time of the extraction from the well. The obtained data are sent together with a report of the temperature, at the time of the measurement, with the aim of converting it into different scales used in oxidation voltage.

[0027] Sensor 6 also provides information of the oxidation potential, having in this way a means for the control of the production pipe.

[0028] The level of fluid between columns is done automatically as well, indicating such in m or indicating the distance between couplings or both at the same time.

[0029] All these sensors do not produce any kind alteration in the yield regimen when out of order, enabling the possibility of being used either jointly or separately.

[0030] Figure 2 shows a graph of a section of the circuit to which the temperature sensors are attached (connector A), the self-potential sensor (connector B) shows the existing polarity in the production pipe to determine the oxidation voltage, the pressure sensor (connector C) verifies it every 30 minutes to evaluate its development, the pH sensor (connector D) and a choke transformer to check salinity (not shown), whose secondary is in contact with the fluid, connected to an LH2101 oscilator, all these inputs connected to the sensors through their corresponding amplification stages are connected to a conversion A/D CI-7 stage the outputs of which send data to the EEPROM CI-20 memory whose directions are controlled by the binary counter CI-19 in such a manner that a sequence of the measurements derived from the sensors is established for the purpose of sending the digital data to the monitoring board in the processor B assembly (fig. 1).

[0031] The processor B assembly also includes a power source, a receptor, a transmitter and outlets to the well controls.

[0032] The control board in the processor B assembly checks the value of the received data and if such surpasses the maximum pre-established critical levels it activates the well controls which consist a deviation valve 11 and a cutoff engine device 12.

Claims

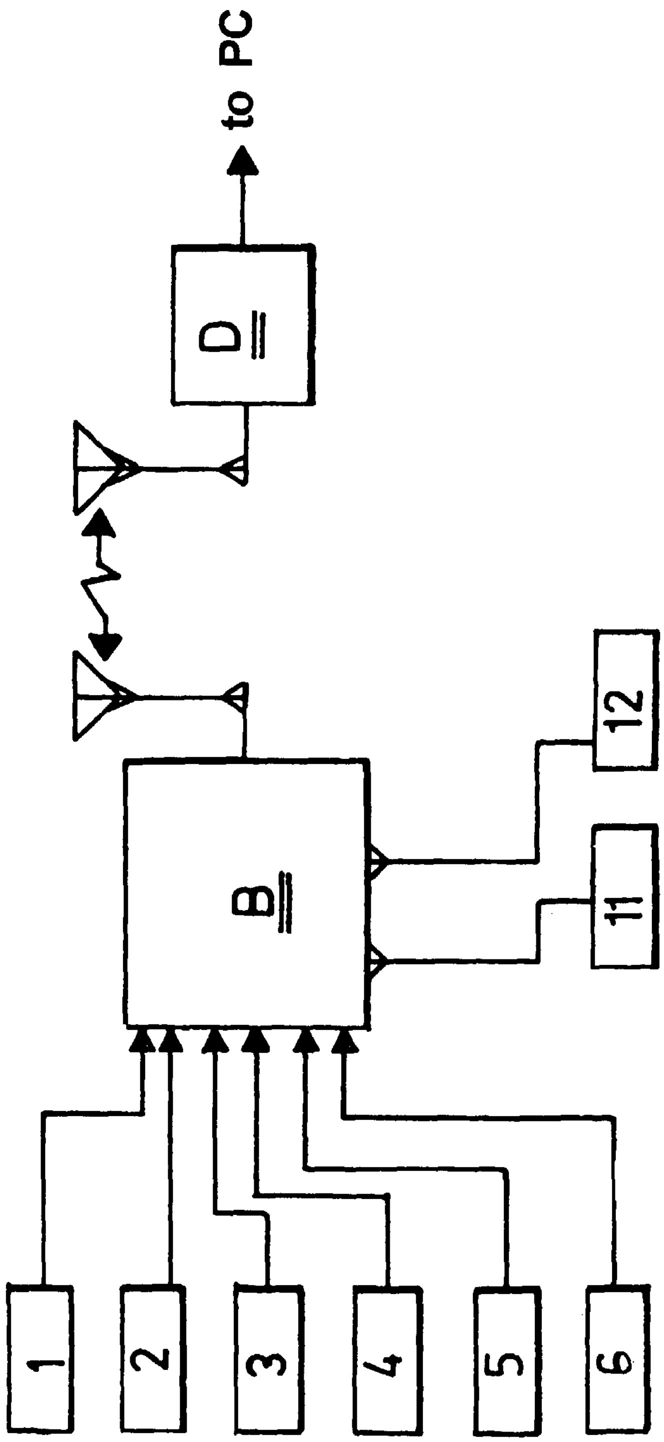
1. A device to optimize the yield of oil wells characterized by a piston stroke sensor capable of measuring parameters of the pump piston (plunger), a dynamometer that indicates operation and power used by the pump, a flow measurement sensor, a sensor that monitors the parameters of the power engine, a degree of acidity gauge of the extracted fluid, a degree of viscosity gauge, a device for the control of salinity in oil, a pressure and fluid level between columns sensor, and a gas detector, all of them connected to the well monitoring device assembly which processes received data and which is connected to a monitoring base.

2. The device as in claims 1 characterized in that such piston stroke sensor comprises a data emitting assembly on the number of piston strokes in fractions of 1/20 in a minute.

3. The device as in claims 1 characterized in that the pH or acidity degree sensor includes a circuit which checks the degree of acidity accompanied by the temperature data at the time of the measurement.

4. The device as in claims 1 characterized in that the flowmeter sensor comprises an element that produces a magnetic signal and not a mechanic one.

FIG.1



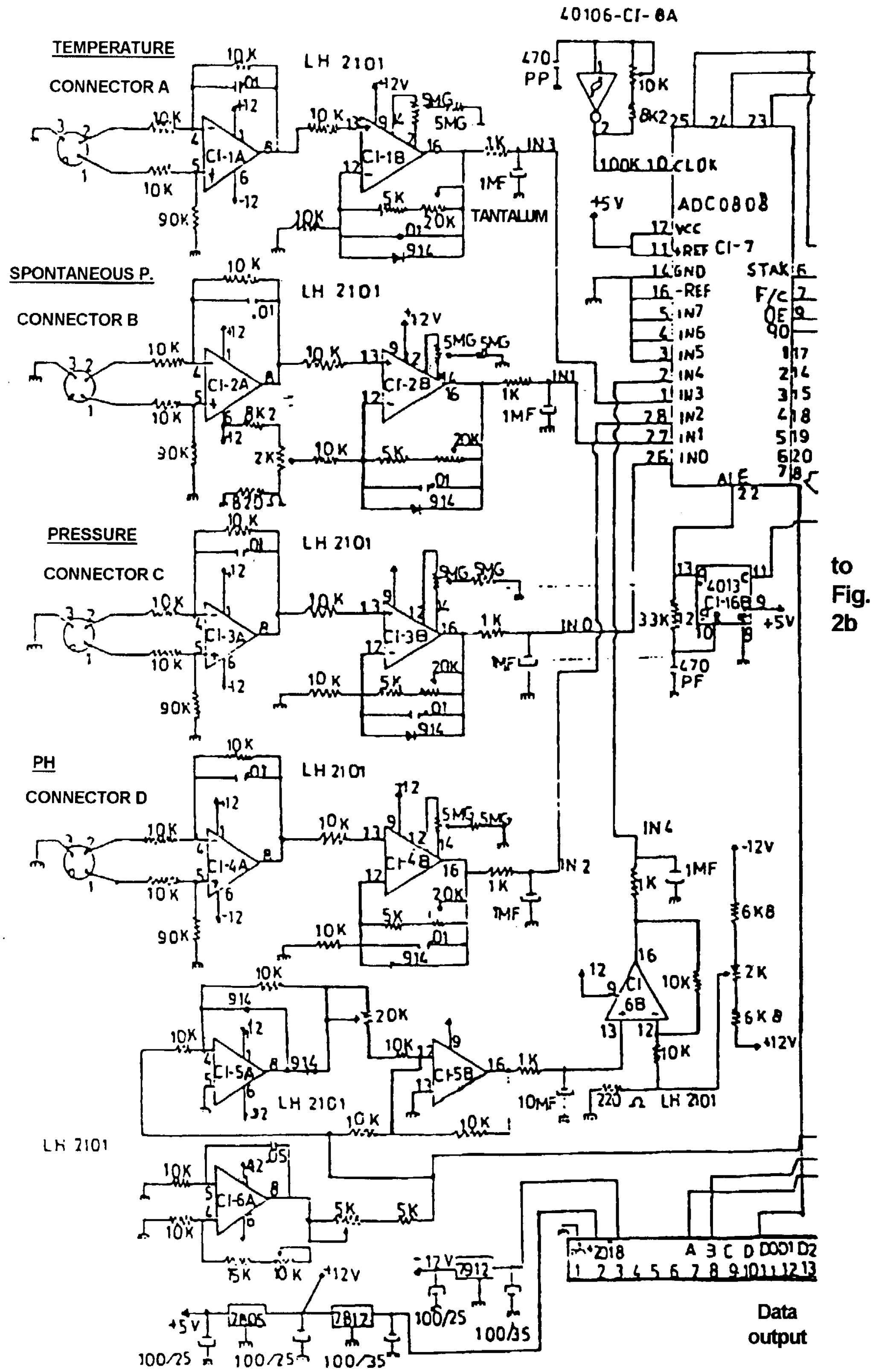

TEMPERATURE
CONNECTOR A
SPONTANEOUS P.
CONNECTOR B
PRESSURE
CONNECTOR C
PH
CONNECTOR D
LH 2101
TANTALUM
40106-CI-8A
ADC0808
to Fig. 2b
Data output

FIG. 2a

from Fig. 2a

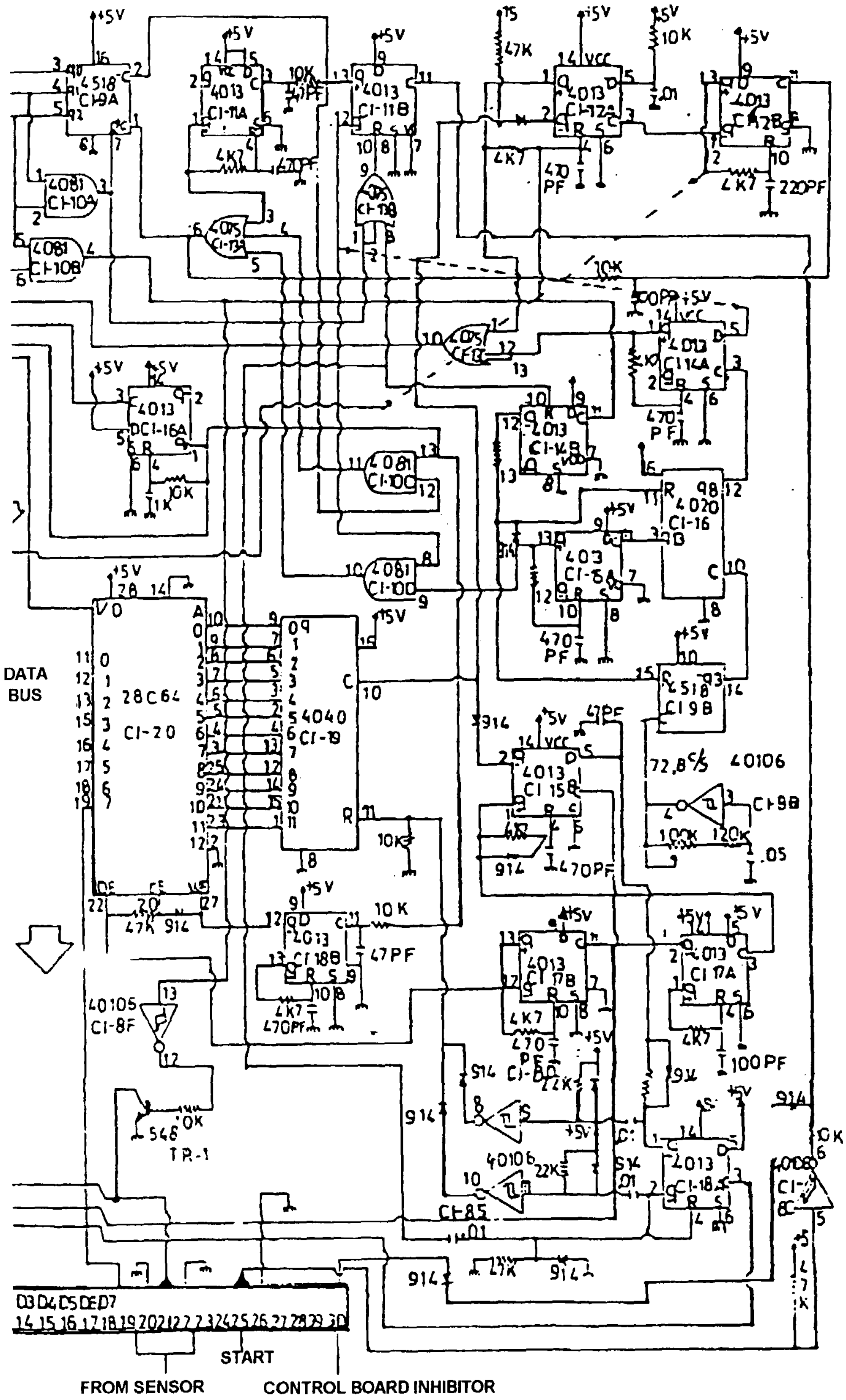


FIG. 2b