[illegible] INDUSTRIES.

[illegible] RECORDING DIVISION

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MAKING A WIRE RECORDER

First, some preliminary remarks to make sure you know what we are talking about; you have probably listened for hours to wire recordings without being aware of the fact, indeed, broadcasting today would be pretty hopeless without such recordings. The Danish scientist, Poulsen, experimenting with the findings of Faraday and his fore-runners, found that he could magnetise a track upon a circular disc of steel and later play the recording back again. This happened in 1898, and was remarkable for the period because Poulsen had no valves for amplification nor any of the useful devices available today. He took out patents, which can be read today in the London Patents Office, but there the matter rested for many years Maybe Edison's coming along with his cylinder phonograph, and later the gramophone helped to push Poulsen's discovery into the background. Fortunately, a German named Steele stuck to the idea and made great strides. If you are sufficiently interested, you can look up Steele's Patents also. Blatner, another German, saw money in the project, and brought one of Steele's recorders to England, where he toured the Music Halls inviting "discoveries" to "Have a go", and listen to their efforts played back afterwards. The instrument was popularised as the Blatnerphone.

The BBC then became interested in the idea and bought some of Steele's machines; their engineers made improvements, and the machines were manufactured in England by the Marconi Co. and called "Marconi-Steele Recorders". These machines used a narrow steel tape, and they were quite good.. Good as they were, however, the back room boys wanted something better, so research engineers in Germany carried out tests with paper and plastic tapes coated on one side with iron oxide, and in the United States engineers experimented with recording on wire. Both systems gave excellent results, but each school will insist that their method is best.

Now, whereas the commercial recording machines in this country cost hundreds of pounds because they are so heavily patented and so nicely made up, the amateur can make for himself a wire or tape recorder for as little as his ingenuity will warrant. Let us first examine the principle; It is well known that if a needle is passed across the pole of a magnet the needle will show symptoms of magnetism, further, if it were possible to have a volume control fixed on the magnet while passing the needle across the pole, then the needle might well be magnetised to different strengths along its length as the volume control was varied. Why not, then, use a piece of steel strip, or steel wire, or grind up some steel into powder and sprinkle it along adhesive tape to see if the action can be carried on for a longer length than a needle? Needless to say, we now know that this can be done. Having got our wire or tape variably magnetised along its length we can take away the magnet and use the wire/tape itself as a magnet; for it is a magnet now. It is a law that if a magnetic field cuts an inductance then current will flow in that inductance; so if we let the fluctuating magnetic fields along the length of the wire or tape cut an inductance (the coil within the head) then we shall get a current induced into the circuit. Gramophone pick-ups, steel guitars, moving-coil microphones, etc., all prove this to be true.

Since it is obvious, therefore, that we need a device to magnetise our wire/tape, let us look around to see if there is anything to guide us. A telephone earpiece seems favourable, because if we pass a current through its bobbins the pole pieces are excited and push-pull the

diaphragm. Fortunately, it was discovered long ago that a telephone earpiece was a pretty poor thing if it was made of steel, because the steel pole-pieces would gorge themselves with magnetism and just simply stay attracted to each other, not wanting to manifest the next word or signal. Luckily, by making the pole-pieces of soft iron and the diaphragm of an alloy called "stalloy" this difficulty was overcome, as neither stalloy nor soft iron will remain magnetised. While stalloy is ideal for telephones it is not much good for recording, but steel is. Therefore, we want something like a telephone earpiece with steel wire or tape passing across the poles. (It is strange that steel should thus come into its own again; readers of forty-five years or over will remember the old horn speakers with metal diaphragm, what ghastly quality they used to emit! more of this later)

Those readers who are mechanically minded will no doubt readily devise for themselves some method of passing the wire/tape across the head from one spool to another. For those not so gifted, there are in these notes several easy-to-make-yourself mechanisms; but first, let us talk about amplifiers for a bit. The writer is frequently asked for guidance in the making of a super-quality amplifier "12 to 15 watts" they say, for playing records. In the writer's opinion twelve watts indoors is paralysing, even if the quality is superb. Many cinemas use nowhere near that strength, and it can be safely reckoned that the home speaker, in repose, puts out about ¼ of a watt; even then the set is moving a relatively heavy diaphragm, which in turn is moving twelve to fifteen hundred cubic feet of air in the room. So get it right out of your head that lots of volume is necessary. All that has to be done is to magnetise a piece of wire or tape a thousandth part of an inch long, so if the tape is ¼" wide, then at any moment one is only operating on a piece of tape smaller than this sign - , or, in the case of wire, smaller than this dot . A good crystal set should adequately supply enough power to do the job. In fact, long before the advent of crystals and crystal detectors Marconi supplied shipping companies with expensive clock-work recorders (which ran out without the operator knowing) to act as magnetic detectors, but dirt cheap crystals put them out of use. If too much power is used for recording, the wire will be over-magnetised and it will be found very difficult to erase the overcharge. Therefore, if you desire to use an amplifier you already have to hand, tap into an intermediate stage where the signal is comfortable on headphones, and feed your recording head from this position. For playback, the head is switched from the recording position over to the input position of the amplifier, and then the whole amplifier might be used to bring the recording up to the desired strength. Care should be taken to correctly match the recording head into the impedance of the anode load of the recording position, and to the grid impedance of the playback.

To summarise the foregoing remarks, it will be agreed that some traversing mechanism for the recording medium, an amplifier, a record-playback head and a quantity of magnetic wire or tape which will remain magnetised are necessary. Now, if we put all these together and made a recording, after the first thrill had worn off we should come to the conclusion that the recording was far from perfect, and if we were lucky enough to possess an oscilloscope we should try to find out why. It is well known that iron plays funny tricks in circuits, and an oscilloscope nicely shows up the reason. Where a nice regular curve is expected, unwanted kinks are found, and the best way found to date to get rid of them is to feed into the head, along with the matter to be recorded, a low frequency bias of 30-35Kc. The term "low frequency" here used must not be confused with audio frequency; 30Kc is a wavelength of 10,000 meters. Long before this discovery, research workers used to erase their recordings by wiping the wire or tape along its length with a magnet. Then someone wondered what would happen if, to save time, the whole spool of wire was placed within an alternating magnetic field, after all, a watch-maker de-magnetises one's watch by placing it near an AC magnet. As was expected, the experimenter obtained equally good results, and what was more, he found that if a little of the AC frequency, particularly at 30Kc, was

fed into the head, it straightened out all those little distorting kinks mentioned a few lines back; the writer wonders whether a little AC LF bias fed into the old-time horn speakers would not have made their reproduction a thing of beauty.

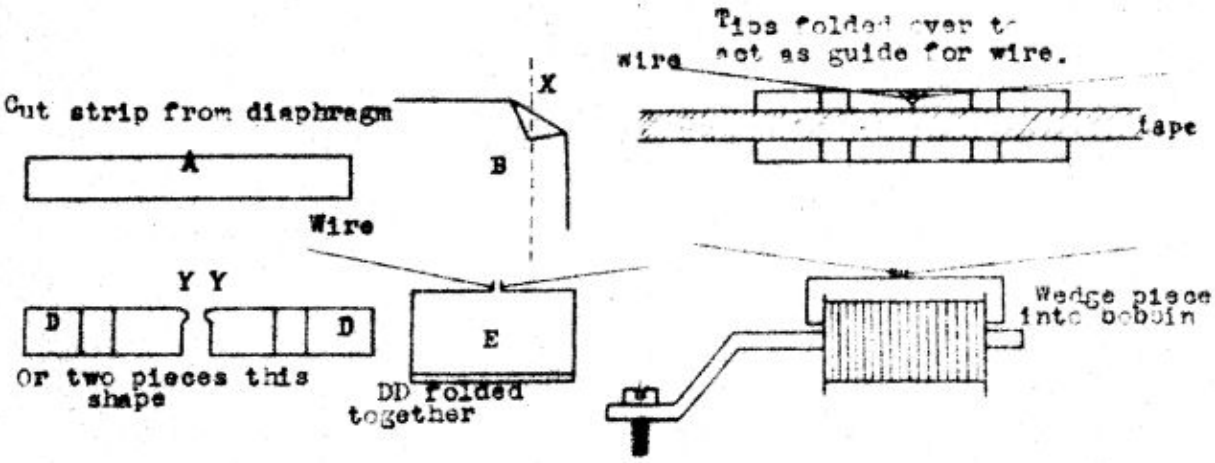
To the best of the writer's knowledge, so far no-one has given an acceptable reason why this biasing frequency does the trick so well. Maybe this bias is to magnetic recording what water is to the colours of a water-colour artist; however, the point remains that we have to have a bias frequency oscillator, and fortunately this also does for erasing unwanted recordings. Now, you might ask "Why 30Kc?". This has been found to be the happy medium; if a higher frequency is used much of it is dissipated through the inherent capacity of the recording head and its associate circuit, and if a lower frequency is used it gets out of hand with the audio frequencies which necessitate a gap in the head of a thousandth of an inch to adequately handle the audio range. Rarely is a half-wavelength larger than the average group of steel molecules. This biasing frequency is very important, and attention should be paid to it as it can make all the difference between good volume and high fidelity, and low volume and poor quality.

Recording heads can have either high or low resistance windings like telephones, but the writer finds it easier and more convenient to use low resistance types. An ordinary telephone or microphone transformer will match the head into the input grid circuit, and a loud speaker step-down transformer will match the head to the anode load of the recording output valve. It might be advisable to use a push-pull transformer, as this will have a higher impedance and probably match better the higher AC resistance of the intermediate valve. Ignore the center HT tap of the transformer.

The writer has made dozens of different types of heads, some utilising a mains transformer stamping, smaller ones using a smoothing choke stamping, down to speaker transformer stampings and stampings cut as small as one's little finger nail. They all gave reasonably good results except that the larger they were the greater was the hum in resultant recordings. Shielding the heads with steel plates greatly reduced hum, and one was forced to the conclusion that the head must be kept as small as possible as, apart from the magnetic fields from mains transformers and chokes, one has to contend with north-south pole earth currents. For your guidance, some heads used by famous manufacturers are sketched on No.3. sheet of the diagrams. The gaps are usually locked with solder to prevent vibration causing a dither in the recordings.

The mechanics of the wire/tape traversing mechanism you can create after your own heart, and make workable by trial and error; but there are two things which are more difficult because you cannot actually see what is going on. These two things are (a) the action on the erase-record-playback head, and (b) the supersonic oscillator coil. Let us first look into (a). A head is not a mystical something from which there can be no deviation; heads can be as varied as are gramophone pick-ups. One manufacturer will prefer separate heads for erase, record and playback, while another will have on head doing erase-record, and another for playback, and yet a third manufacturer will decide upon one head for doing all three jobs. The simplest head made and used by the writer was made from a stripped-down-telephone earpiece. The parts used were, one of the bobbins freed from its polepiece, and the stalloy diaphragm. A strip was cut from the latter wide enough to pass through the bobbin the wide way; this can be likened to passing a ruler through a packet of ten Players. The ends of the strip are then bent round the bobbin so that they meet; see diagram on the following page. A piece of brass strip is filed up to fit tightly into the bobbin to serve as a means of mounting and at the same time to hold firm the stalloy core.

Telephone Bobbin Head



This type of head is mounted so that the gap is across the tape, but wire runs along the edge of the stalloy so that the wire forms the top of a "T", the upright of the "T" being the gap. If you make such a head it can be used for erase, record and playback if you wish, but for recording with wire you will have to have some means of keeping the wire in contact with the stalloy. If you use the method illustrated above, be sure you make the little "ears" at the corners of the strip which, when turned over, keep the wire passing steadily across the gap. You can practice first with a piece of paper; by turning down a corner you can get effect "B" above. It should now appear obvious that the gap which would be formed by abutting a similar piece would, or should, be 1/1000th of an inch, but the "ears" would be sloping away from the gap. This can be overcome by cutting along the dotted line in "B" by folding out the "ear" you would get projections like "Y" in Fig.D. The diagram at the very bottom right-hand corner of sheet Fig. 3 of the diagrams shows another way in which the wire could be made to run along the edge of the stalloy. If the student is lucky enough to be able to obtain a piece of mumetal or permaloy or a thicker piece of stalloy, then a groove might be cut in the material itself in the fashion illustrated.

Even at this early stage, one is naturally anxious to see what results are obtainable, so try this: connect the two ends of the bobbin to the pick-up sockets of your radio and, failing the possession of a tuning fork, strike a piece of steel bar to ring and hold it close to the gap in the head. The amplified note should be heard in the loudspeaker. If you can do this with a piece of ordinary steel bar, think what results are obtainable with a piece of magnetised wire or tape.

Using a type of head with only one winding, you will have to make it do its various jobs by switching. For record position it will be switched to the output stage, for playback to the input stage, and for erase it will be so switched that the current from the supersonic oscillator saturates the core of the head, with the result that the magnetic fringe spreads beyond the limits of the thousandth of an inch gap. In this type of head you can use either high or low resistance windings, but the low resistance type must be coupled to its relevant circuit via a step-down transformer.

Another type of head you may like to try is made from a thicker piece of material than the stalloy diaphragm. Don't be put off if you are unable to obtain a piece of stalloy, mumetal or permaloy, but try using a piece of soft iron. Even if results are not excellent with this, the piece of soft iron will make good practice for you. Mark out your material to the approximate size of the Webster head illustrated on sheet Fig. 5, bearing in mind before you start the size of the bobbins you have been able to make or scrounge. Drill the holes, then file away the unwanted metal to form little "windows". To make the gaps, shear through with a pair of tinman's snips; any twist or buckle must be tapped out afterwards so that the material is flat. Having done this, the

next

job is that of making a groove in the edge of the material. This will offer no difficulty to the master mechanic but may be a teaser to the amateur. The proper tool to use for the job is a circular 6 thou. slitting saw, but this calls for an accurate lathe; the writer favours a circular hardened steel wheel glass cutter, which can be bought from an ironmonger's for a few pence. The piece of metal to be cut will need to be blocked up on either side and held in a vice, and then care must be taken to see that the groove is well down the centre of the piece of metal. The groove should be about 6 thou. wide and deep, as the wire is 4 thou. in diameter.

Having described some different types of heads, we hope you will be encouraged to try out pet ideas of your own. Before leaving the subject, however, it will be as well to mention the number of turns the writer finds satisfactory (but by no means suggests should be rigidly adhered to). In the case of the first head described, the telephone bobbins used were 4.1 ohms and 810 ohms; both worked well, but a transformer was needed for the 4.1 ohm bobbin. For the second head (see Fig.4. Webster Head), an original head was obtained from the U.S.A. It was found that the larger bobbin had a resistance of 400 ohms, number of turns was not known, one of its lead wires broke off short, and the bobbin was rewound with 500 turns of 42 gauge enamelled, giving a D.C. resistance of 20 ohms. The 500 turns was a shot in the dark, no special calculations were made, but since the results were satisfactory we experimented no further with this particular head. The smaller bobbin had 20 turns of 30 s.w.g silk covered. One point about which you must be careful is to keep the metal parts in the head as small as possible to avoid hum. When the writer tried using larger transformer stampings he found that the hum increased with the size of the stamping, and the humniest of all was made from a mains transformer stamping. Moral - keep it small!

Notes on the circuit

1. Although the input lead marked P.U (Pick-up) on the socket P1 in the circuit diagram is not shown as screened it might be found necessary to screen this lead right back to the grid of V2 if hum is experienced, and earth the casing of volume control R6 .

2. Microphone transformer T3 should be orientated about its axis to find the nodal point, if possible. This nodal point is to be preferred if all possible sources of hum are to be overcome.

3. In the event of trouble through "motor-boating", try separating out the cathodes Nos. 3 & 6 of valve V2 (that is, feed each cathode separately instead of through common bypass resistor R8 and bypass condenser C9)

4. The object of resistor R17 is to soak up the wattage taken by the 30Kc oscillator when the oscillator is switched out of the circuit during playback, and so to keep the potentials of V1 and V2 reasonably constant, so that they do not rise when the load of V4 is not required. Alternatively, an extra stage of amplification can be switched in, then T2 will be put in the anode of the new stage.

5. When winding back the wire with type No.4 mechanism, remove the loop around the capstan, taking care not to twist the wire and kink it throughout its length.

6. The "Crown" international standard-sized spools are the correct size to slip within the rubber tyred pulleys supplied by us. This is necessary as the spools revolve at varying speeds as the amount of wire on the spool increases or decreases.

7. It should be understood that there is constant wear on the recording head. The wire passing across the gap gradually wears the metal away. Fortunately, heads cost only a few pence to repair, so that this wearing offers no difficulty.

8. It will be noted that a toggle switch (S2, Fig.1) is used in the primary of the mains transformer, and you may wonder why a volume control with switch combined is not used. It is because hum is experienced due to the AC fluctuations in the switch adjacent to the volume control track feeding into the grids of V2.

9. Should the constructor desire to use magnetic tape instead of wire the only change necessary will be in the construction of the head, and there the very simple telephone bobbin head described in these pages might well be used. Although no wire laying mechanism will be needed, constructors of tape recorders must devise some compensating mechanism to allow for the difference in speeds as the tape increases and decreases on the spools. This is important in tape as the spools holding the tape are 7" in diameter, as against the 3" diameter of a spool of wire.

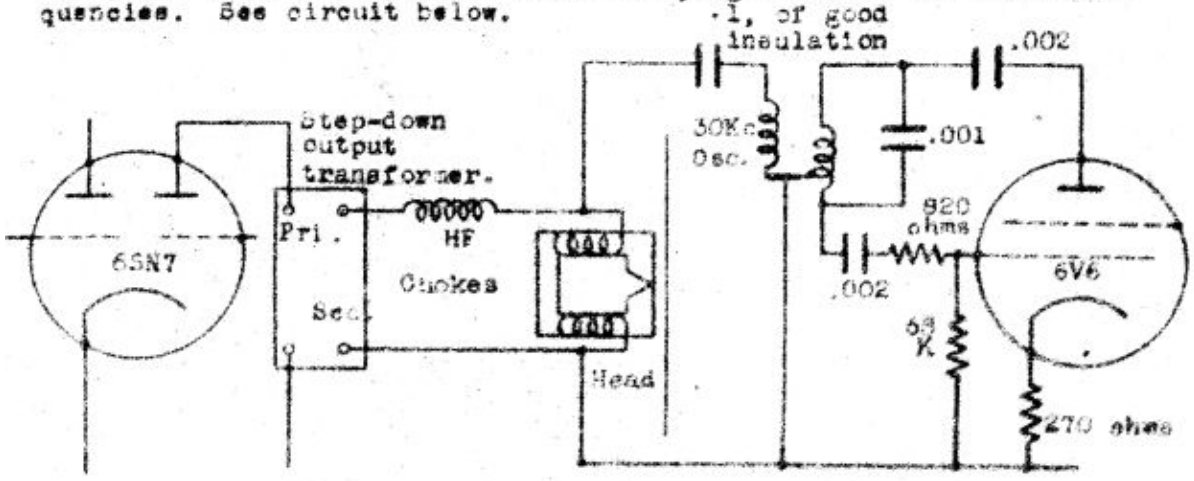
10. Fig.1, Ch2 - this choke is the primary of a standard 5,000 ohm output transformer, the secondary of which is not used and is left open. The choke correctly loads up the circuit, and the valve operates as a true beam tetrode.

11. R9, Fig.1 - This rheostat regulates the amount of current fed into the recording head. Care should be taken not to over-run, as difficulty will be experienced in adequately wiping out the unwanted recordings.

12. Direction of wire or tape - The wire or tape should first pass over the erase head to thoroughly remove any previous recording, then over the recording head, and lastly over the playback head so that the recording can be monitored for quality. Where only one head is used for erase-record-playback this cannot be done.

13. Numerous enquiries received reveal that many constructors believe that the wire or tape must traverse at some specific speed; this is not so. Wire can traverse at anything from 9" to 3' per second. The point to remember is that you must playback at the same speed at which you record, otherwise the recording will have a dragged effect. Tape is normally run at a speed of 7½" per second, but here again the speed can be faster or slower, as you prefer.

14. There is no supersonic bias coil on the head illustrated on page 4 for the supersonic frequency. Therefore it is necessary, if you desire to use this type of head, to feed the 30Kc frequency into the head capacitively; a condenser of about .1 mf should be connected between the arrowhead marked to S1C and point 2 on the head. Further, to prevent the supersonic frequency dissipating itself through the stepped-down winding of T2, HF chokes should be inserted in the line from T2 to earth and T2 to S1a. This will drive the HF bias into the head, and offer no impedance worth worrying about to the audio frequencies. See circuit below.



15. To ascertain whether the 30Kc oscillator is working correctly and pushing out the supersonic bias, connect across the oscillator coil winding between earth and point "c" a 6.2v .3amp dial bulb, which should light up. Disconnect this when erasing.

16. Constructors sometimes write in asking for alternatives to the "Crown" recording wire. Although there are other recording wires available in this country, there is no equivalent to "Crown"; it is accepted by the trade as the finest available. However, results can be obtained from iron wire, tungsten-steel wire and carbon-steel wire. If you want a short piece of wire for testing heads, get a steel guitar or banjo string four thousandths of an inch thick and stretch it between two nails on a board. A recording can be made and played back by sliding your head along the wire. You will find that the wire is only long enough for a simple statement like "Good morning", but it will suffice to convince you that good results are possible. If you want reels of wire for aligning the traversing and laying mechanism we can supply them at 2/6d for a ¼lb reel.

17. Many different types of heads are sent in for our comments, and most of them have one fault in common - the roughness of the working edges. The edge should be perfectly smooth, and finished off on a fine stone; burrs and jags will damage the wire.

18. An overall fidelity of 80-9,000 cycles at plus or minus 3db is possible, and should be expected if reasonable care is taken in construction and choice of amplifier parts.

19. Many constructors write in asking what is the necessary power for a suitable motor. A motor no stronger than the ordinary gramophone motor is well suited to the purpose. During the war, clockwork motors were used to work recorders in the field where no power was available; these motors were exactly the same as motors used in clockwork gramophones.

20. Care must be taken to see that the voltage on V4 does not exceed 300v.

<u>More about the HEAD</u>

We are getting a number of letters which indicate that constructors are scared stiff of tackling the making of the erase-record-playback head. Reading between the lines reveals that constructors are reluctant to believe that anything so simple as the devices indicated in these notes and drawings can possibly work. They seem to think that there is some hidden mystery which will only be brought to light by writing to us and asking all sorts of peculiar questions.

It is said that "a little learning is a dangerous thing", and also that "fools step in where angels fear to tread". Our letters prove both sayings to be very true, and it will be admitted that the so-called fools are very often the people who get things done in this world.

As a parallel, take microphones; one of the most sensitive microphones it is possible to have is made by suspending a pastry-board vertically in air; into the board are driven two nails, about an inch apart, and a third nail or a thin carbon rod is then lightly rested across these; leads are taken from the two fixed nails to an amplifier. A fly alighting on the board will sound like a block-buster, and its walk a continuous thunderstorm! However, if we told you to do this as part of the construction of a wire recorder, constructors would worry themselves pink as to what size the board should be, what would be its frequency response, had it bass cut off or uplift, had it treble cut-off or uplift, what size carbon granules should be used and how many, does the number affect frequency, and so on and so forth, not realising that it just doesn't matter.

Should you, dear reader, suffer such inhibitions, then make up one of the following absurdly simple heads. But in any case, do get going an don't frighten yourself with bogies that do not exist.

Take a transformer stamping,

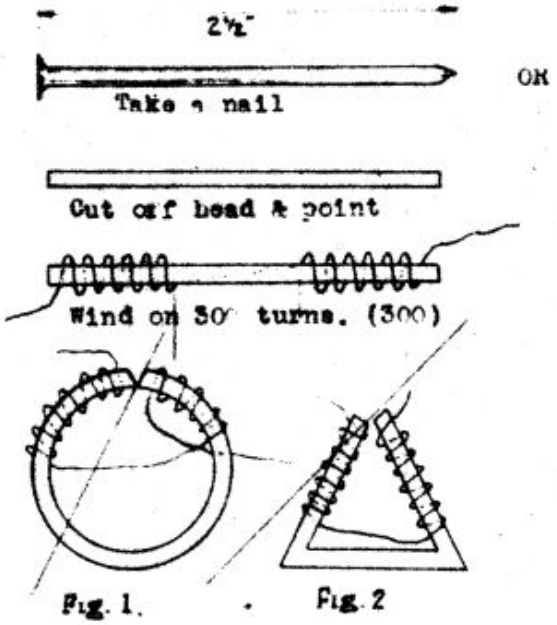


Fig. 1. Fig. 2

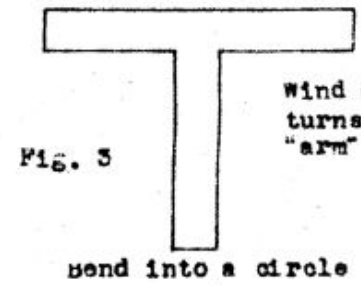


Fig. 3

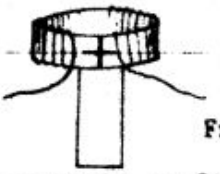


Fig. 4.

Use upright as fixing.
Set gap to one thousandth of an inch, and solder.

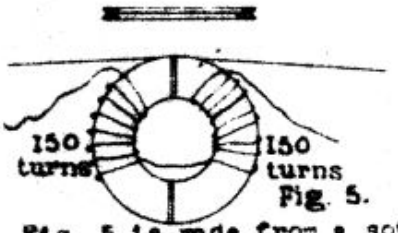


Fig. 5.

Fig. 5 is made from a soft iron washer, around the edge of which is turned a slight grove, cut in half, and solder gap.

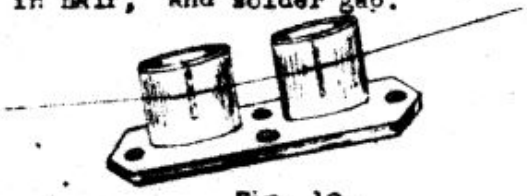


Fig. 10.

Fig. 10 shows the fitting we can supply for housing two assemblies like Fig. 7, one for erase and one for record-playback.
The set of parts, including wire, metal etc., 7/6d. However, the average amateur should be able to find similar pieces in his junk box to make the head for about threepence.

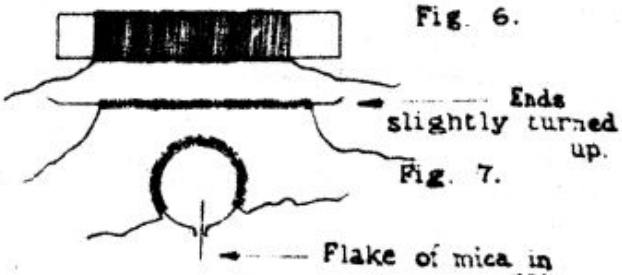


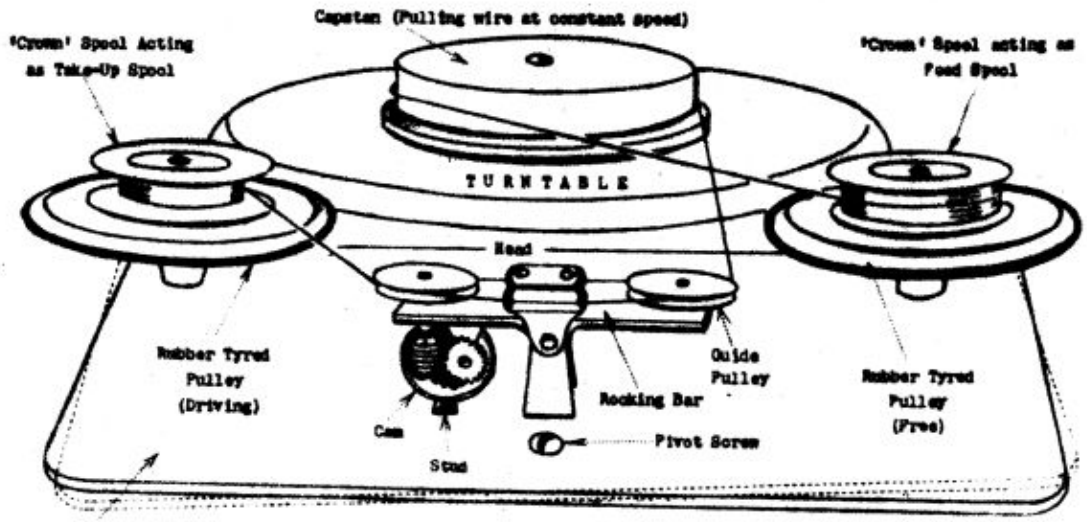
Fig. 6.

Fig. 7.

Fig. 9.

Fig. 8.

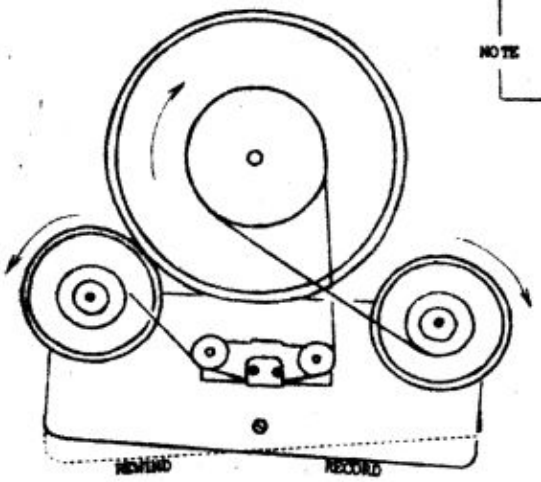
Fig. 6 is a strip of metal, with approx. 300 turns wound on, not too thin. The strip is then coiled to form Fig. 7. Fig. 8 is a piece of brass tubing cut down one side, and Fig. 7 is fitted into it so that the gap fits into the cut of Fig. 8. The gap and cut should be soldered carefully, and then filed down flush to make a smooth finish that will not abrase the tape or wire as it passes across.



In this design the Base Plate pivots about a screw engaging either left or right tyred Pulley on rim of Turntable. As shown, the left one is being driven; the dotted line shows position of Base Plate for rewinding, with the right hand Pulley engaged.

NOTE

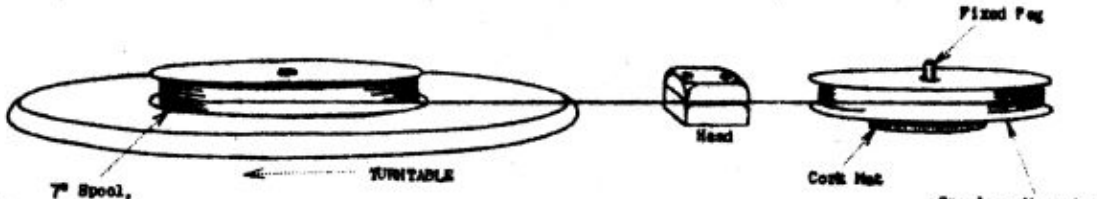
The wire passing over the Guide Pulley rotates it, and, in turn, the Worm. This revolves the Cam (more slowly) which rides up and down on the Stud, rocking the bar and thus laying the wire evenly on the take-up Pulley.



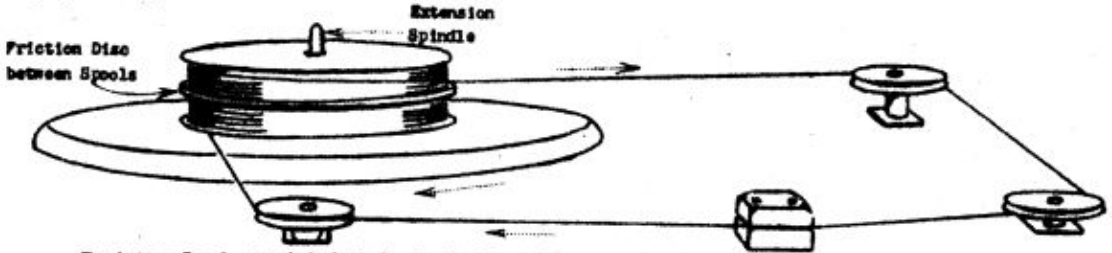
PLAN OF ABOVE MECHANISM

FIGURE 4. A SIMPLE WIRE RECORDING ATTACHMENT UTILISING A RADIOGRAM

BELOW ARE SHOWN TWO OTHER SIMPLE SCHEMES USING A RADIOGRAM.



7" Spool, Felt covered on top to prevent records slipping if played on top



The bottom Spool, carried clockwise by the Turntable winds the wire from the top Spool. The latter is pulled against its natural tendency to turn clockwise.

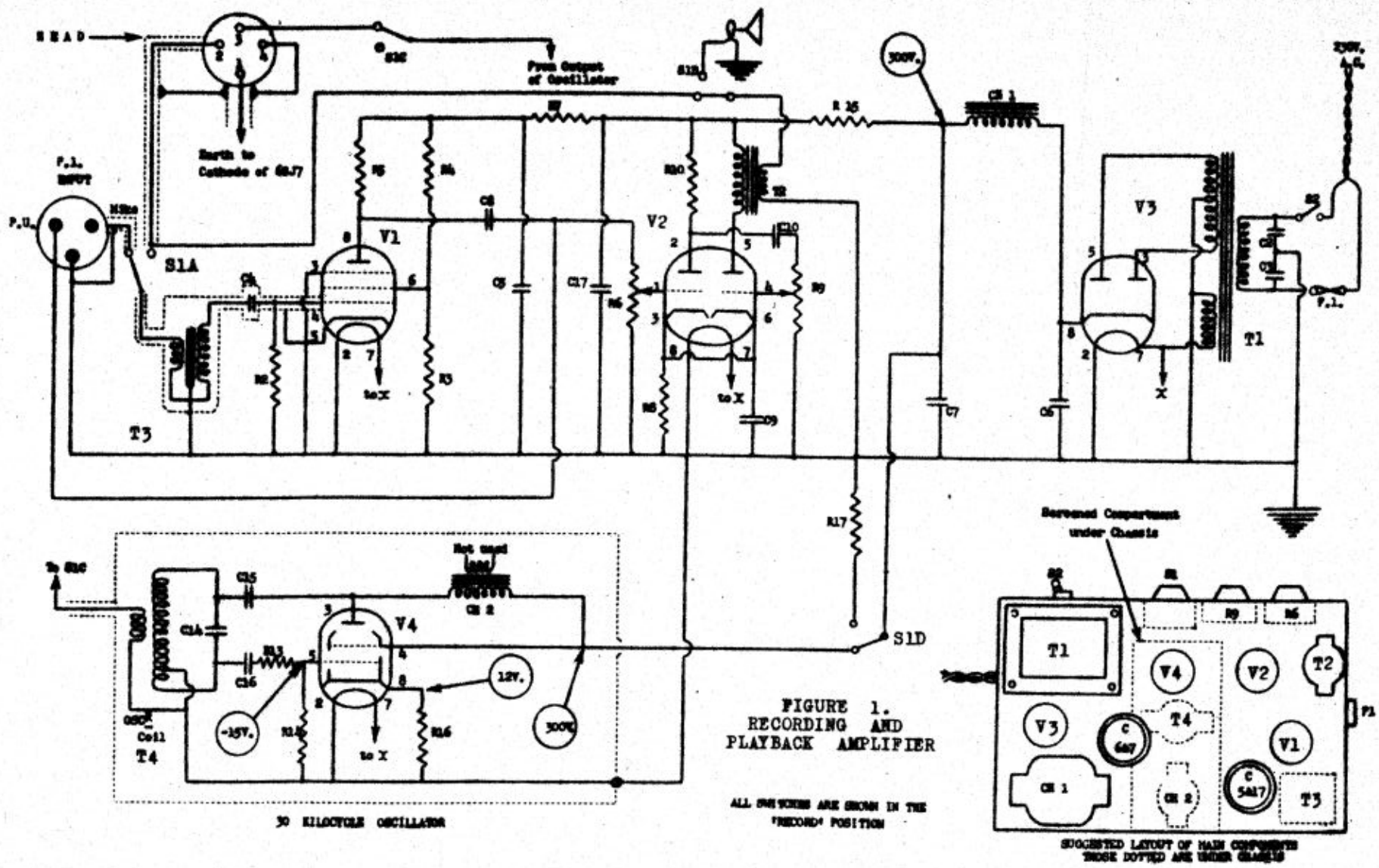


FIGURE 1.
RECORDING AND
PLAYBACK AMPLIFIER

Components for the "CROWN" High Fidelity Wire Recorder

Amplifier Parts

Resistors - R1	4.7 megohm ½ watt,	6d.	Condensers -		
R3	47K ½ watt,	6d.	C2	.05mfd, 400v wkg.	2. -.
R4	220K ½ watt	6d.	C3	" "	2. -.
R5	220K ½ watt	6d.	C4	.01mfd " "	1. 6.
R6	1 megohm pot.	4.9d.	C5 & 17	16 plus 8, 450v	6. 9.
R7	100K ½ watt	6d.	C6 & 7	16 plus 8, 450v	6. 9.
R8	470 ohm 1 watt	9d.	C8	.02 mfd	1. 6.
R9	250K pot.	4.9d.	C9	25mfd, 25v wkg.	2. 3.
R10	39K ½ watt	6d.	C10	.02 mfd	1. 6.
R13	820 ohm ½ watt	6d.	C14	.001mfd. 600v mica	1. 6.
R14	68K ½ watt	6d.	C15	.002 " " "	1. 6.
R15	820 ohm ½ watt	6d.	C16	" " " "	1. 6.
R16	270 ohm ½ watt	6d.	C17	See C5.	
R17	10K 10 watt	3.6d.	Condensers & resistors		47. 6.

T1 - Mains transformer, 230-0-230, 6.2v filaments, .3amp. If a directly heated rectifier is used, it will have to be heated by separate filament windings . . . . . 38. 6.
T2 - Output transformer to match impedance of V2 (6 - 4 - 5), and also speaker . . . . . 9. 6.
T3 - Screened input microphone transformer . . . . . 6. -.
Z4 - 30Kc oscillator coil, primary and secondary windings . . . 5. 6.
Ch 1 - Smoothing Choke, 10/6d. Ch 2 - speaker transformer, 9/6d. 20. -.
S1 a, b, c, d, - 4-pole 2-way rotary switch . . . . . 4. 6.
S2 - Toggle switch . . . . . 2. 6.
F1 - 1 amp fuse and holder . . . . . 1. 3.
P1 - Input socket . . . . . 9.
Valves - V1, 6SH7 @ 12/10d. V2, 6SH7 @ 12/3d.
V3, 6K5 @ 11/-. V4, 6V6 @ 12/10d. . . . . 54.11.
4 - Valveholders @ 9d each . . . . . 3. 0.
Suitable chassis for amplifier . . . . . 7. 6.

TOTAL COST OF KIT FOR AMPLIFIER - £9. 15. 5d.

Parts for Wire Recorder

Set of parts, head motor and recording wire, for wire-laying and traversing mechanism . . . . . £3. 14. 3d.
Motor - "Crown" recording . . . . . 2. 15. -d.
Spool of "Crown" recording wire, 3,000ft, sufficient for ½ hour's playing at 2ft. per second, including international standard sized aluminium spool . . . . . 2. 8. 6.
Spare spool @ 7/6d & 2 capstans @ 6/6d each . . . . . 1. -. 6d.

TOTAL COST OF KIT FOR "CROWN" WIRE RECORDER:

Less amplifier . . . . . £10. 5. 9d.

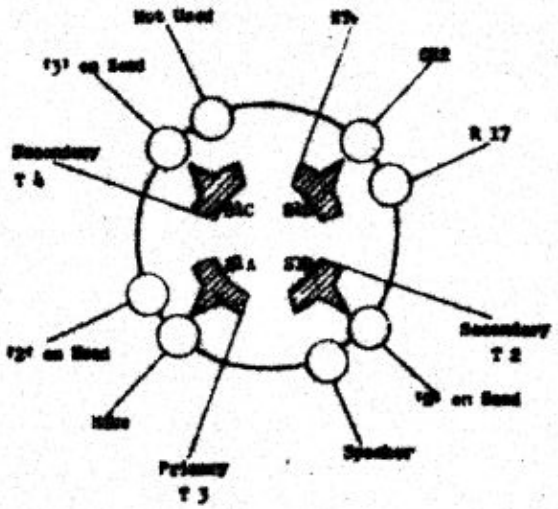
Including amplifier . . . . . £20. 1. 2d.

ALSO IN STOCK - Spools of "Diamond" recording tape, 1,200ft, sufficient for ½ hour's playing at 7½" per sec. £2. 15. -d.
Spare spools for tape . . . . . 4. 6d.

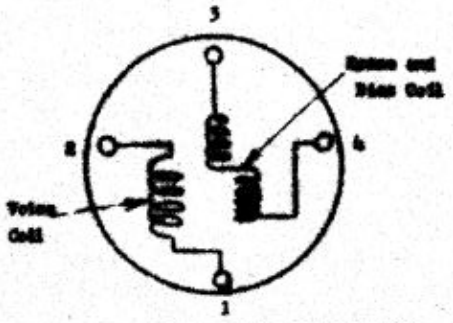
Helpful Oddments - ½lb reels of wire (non-recording) for aligning mechanism, 2/6d; 3" bakelite tyred pulleys, 2/6d each; left drive wheel & idler wheel 1/6d each; thin pieces of mumetal, 6d each; heart-shaped cams, 3/6d each; bearings, 3/16ths", 1/4", 5/16ths" & 3/8ths" 3/6d each; silver steel shafting, 13" lengths, 5/16ths" or ¼" 1/6d per length.

Enquiries for odd components and pieces of metal to aid construction welcomed; please make a rough sketch of the size and shape required. All queries by phone or letter promptly dealt with (Phone ILF.2066). Demonstrations given at our workshops; it will help if you write or phone first for an appointment.

Judge Industries (controlling Park Radio), 785 Romford Rd., London, E.12.



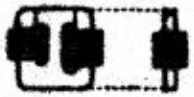
SEPARATE VIEW OF DEVICE CONNECTIONS
ON AMPLIFIER (R1)



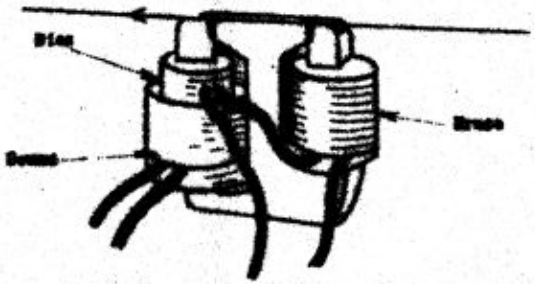
CONNECTIONS OF RECORDING
AND PLAYBACK HEAD

FIGURE 2.

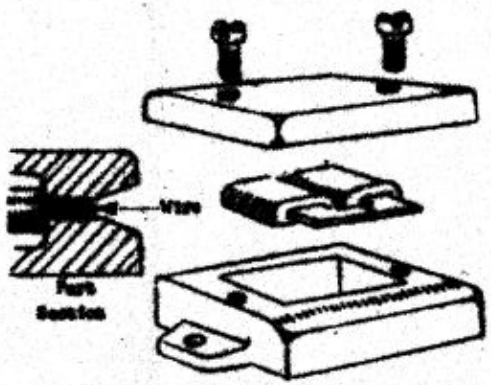
FIGURE 3. TYPES OF HEAD USED COMMERCIALLY OR SUGGESTED FOR CONSTRUCTION BY AMATEURS



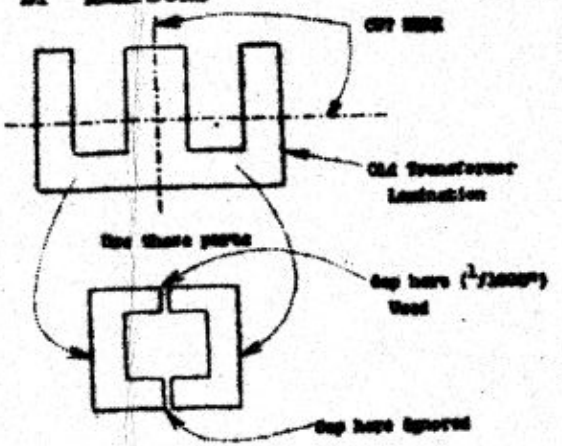
Actual size of "Universal"
Head (Emerson)



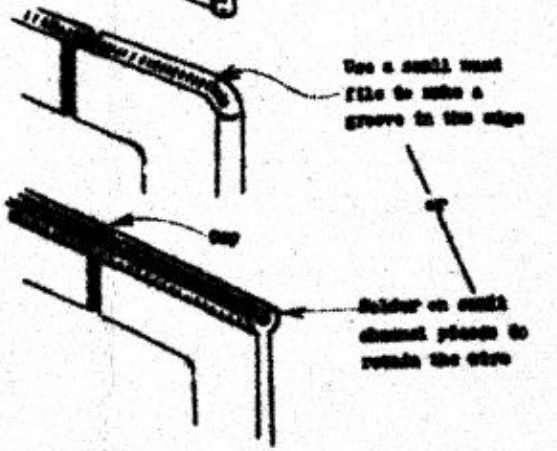
Enlarged view. The head used
has gaps.

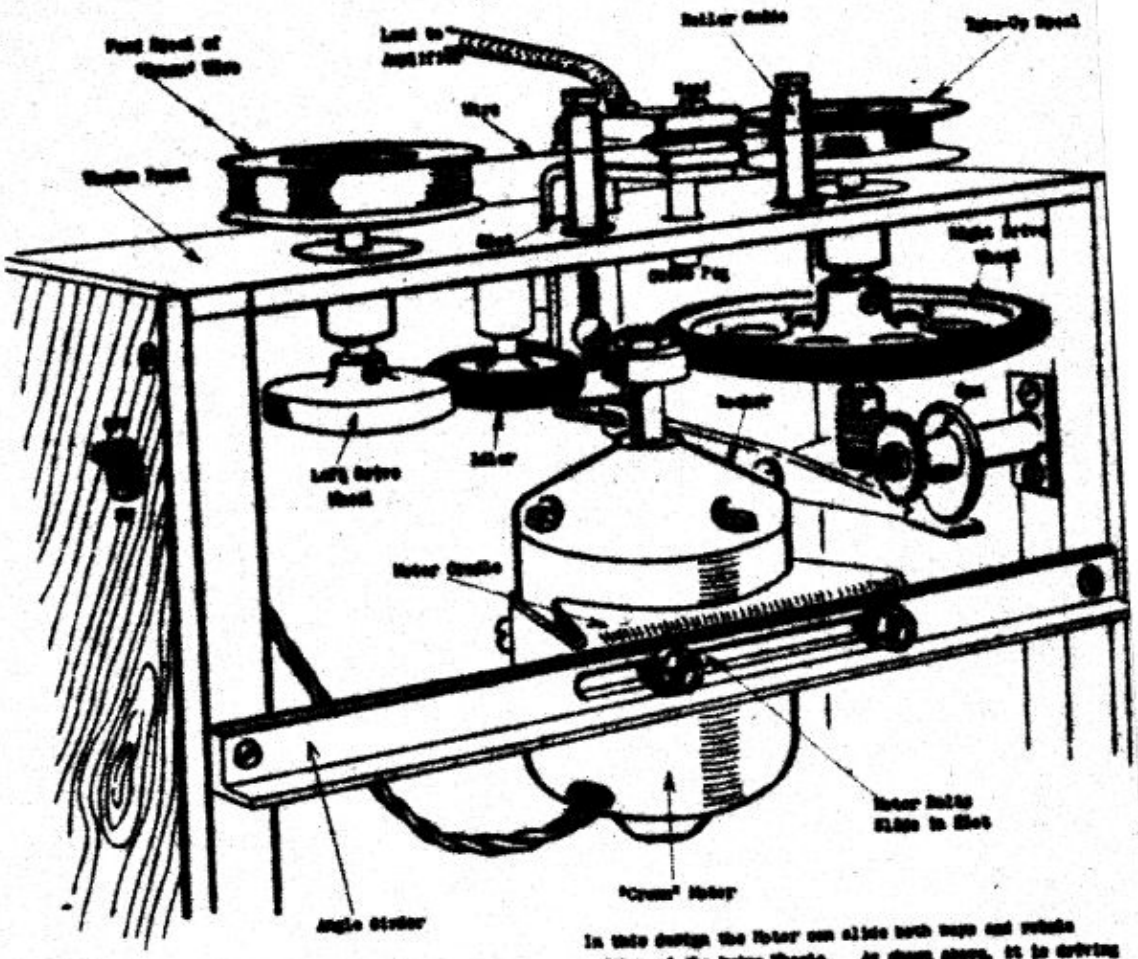


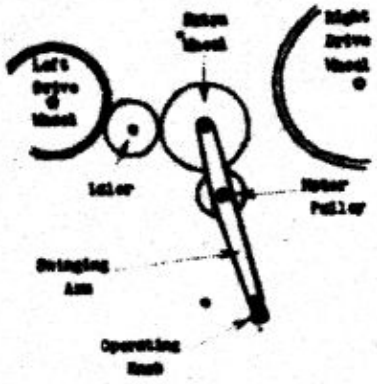
Whatever type of head is used, it must be
securely clamped down to avoid vibration.
In the simple head shown above, the head is
"sandwiched" between blocks of brass (not slow
to wear out). Any other non-magnetic
material will do, e.g. Perspex or aluminium.



If wide enough, the
ribbon may be bent over
to form a retaining core
for the windings

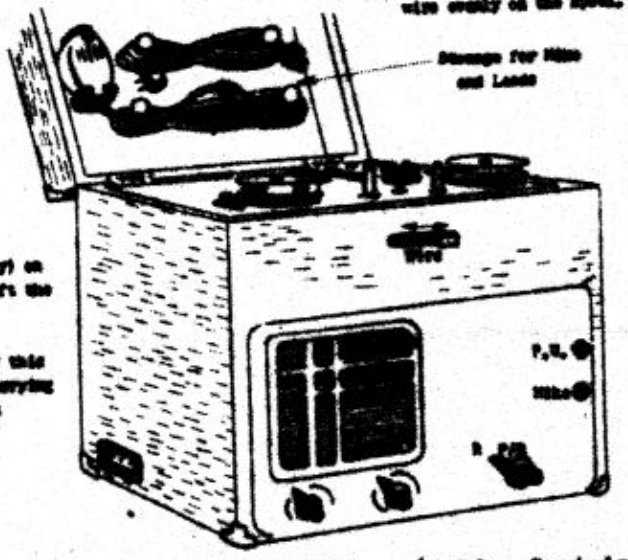






This swinging arm may be fitted (loosely) on the Motor Shaft to avoid having to shift the whole Motor when reversing drive.

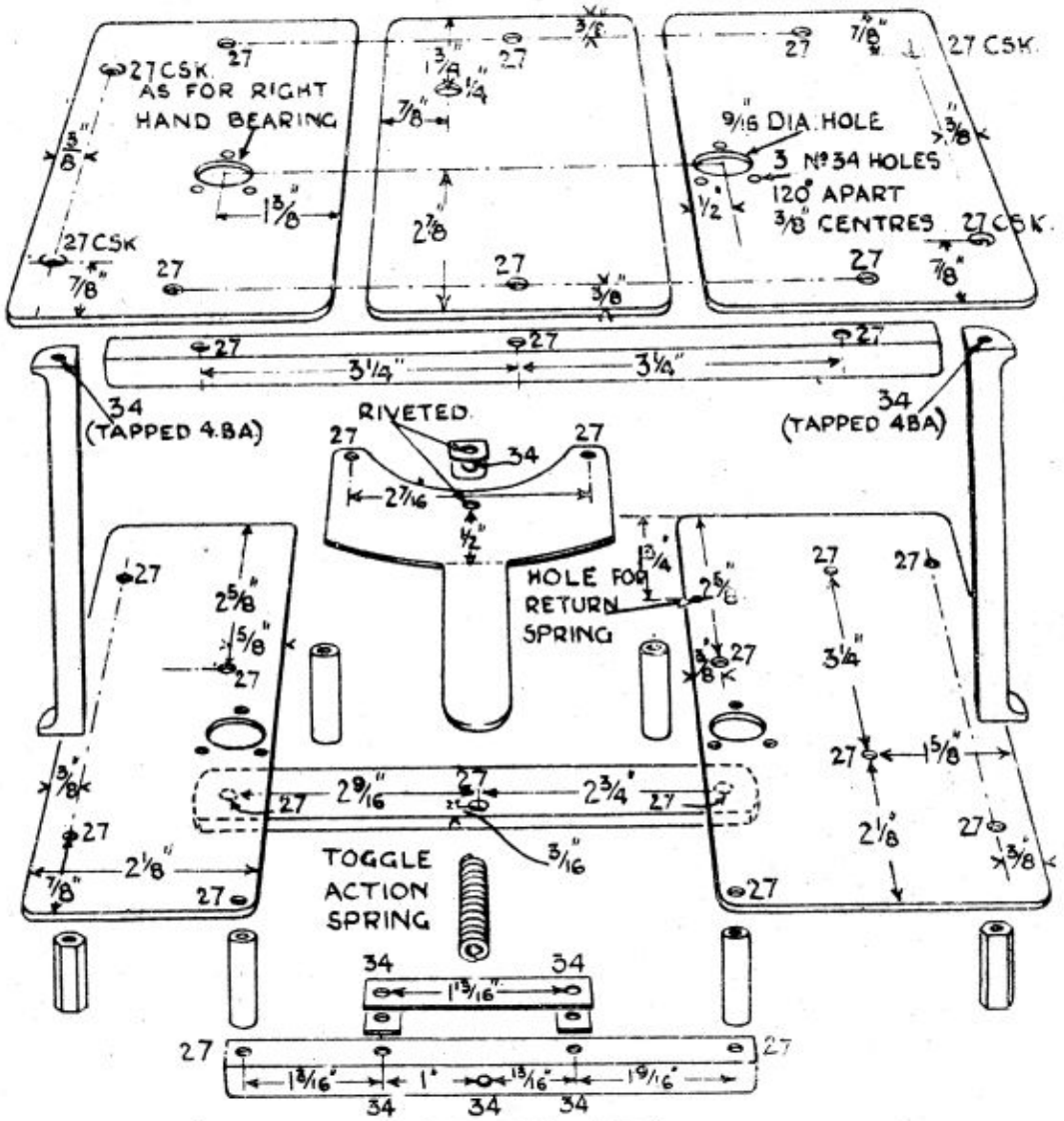
To make a 'Professional' job of this mechanism it could be built into a carrying case with the Chassis and Speaker as illustrated on the right.



In this design the Motor can slide both ways and rotate either of the Drive Wheels. As shown above, it is driving the right hand Wheel (to record). Tape moved to the left the Motor drives the left Drive Wheel via the Idler which reverses the direction of the wire. Owing to the smaller 'Gear Ratio' the wire is wound back more quickly.

The Worm and Wheel drive the Cam which by means of the Rocker moves the head up and down, thus laying the wire evenly on the spool.

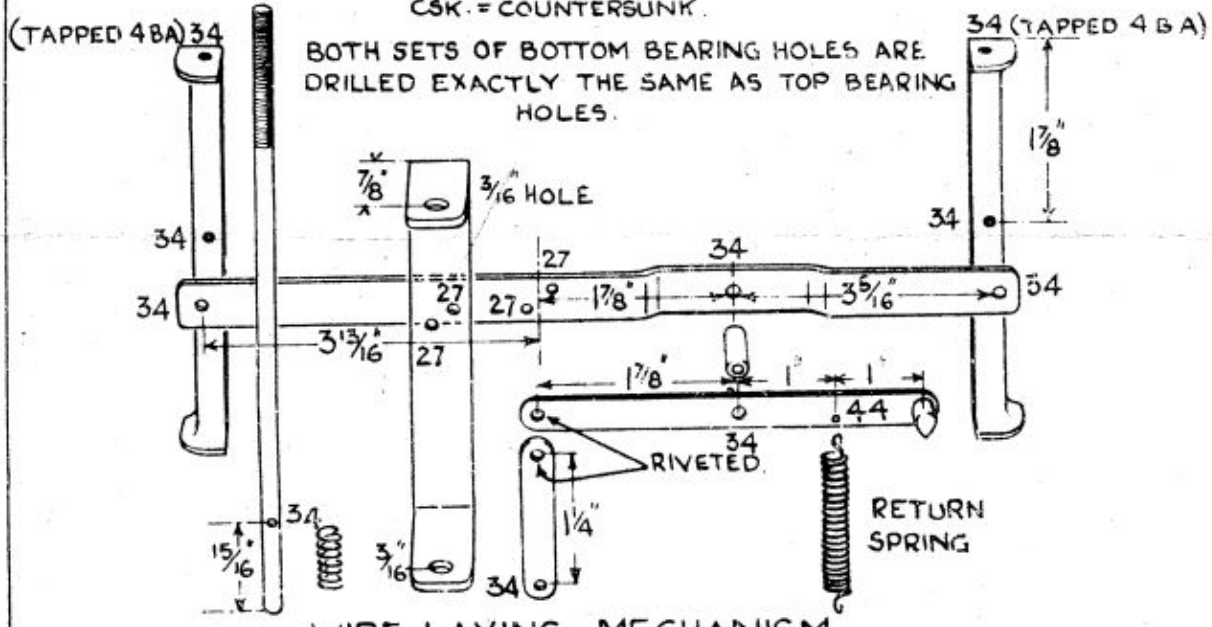
FIGURE 5. A MORE AMBITIOUS RECORDER (Self Contained)
The prototype of this model is in current use by
P A R K R A D I O



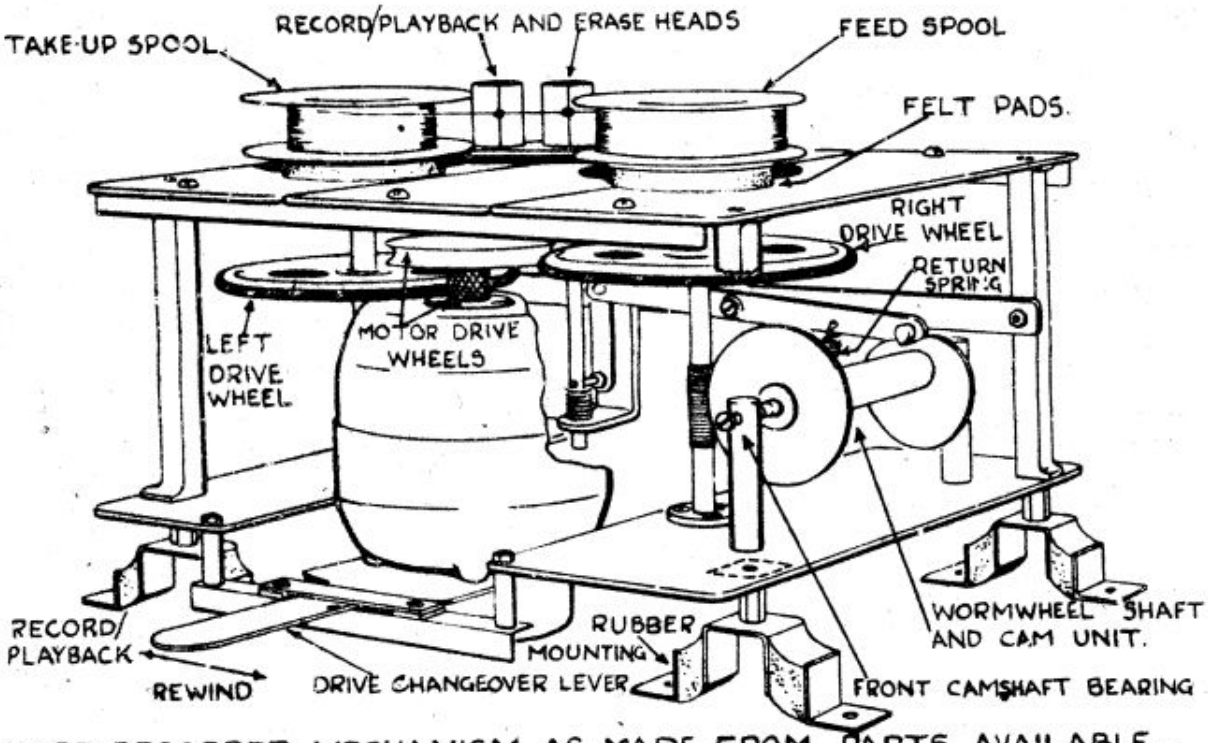
MAIN FRAMEWORK.

(NUMBERS BY HOLES INDICATE DRILL SIZE)

CSK. = COUNTERSUNK.



WIRE LAYING MECHANISM.



WIRE RECORDER MECHANISM AS MADE FROM PARTS AVAILABLE.

(NEAR CORNER PILLAR SHEWN CUT AWAY)

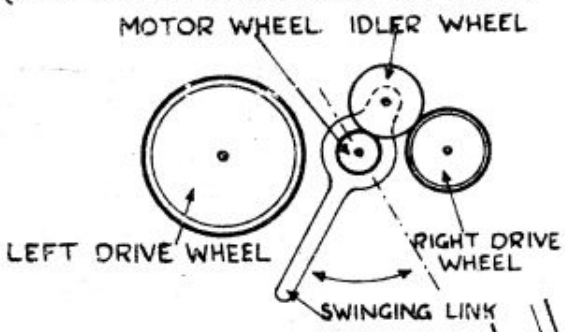
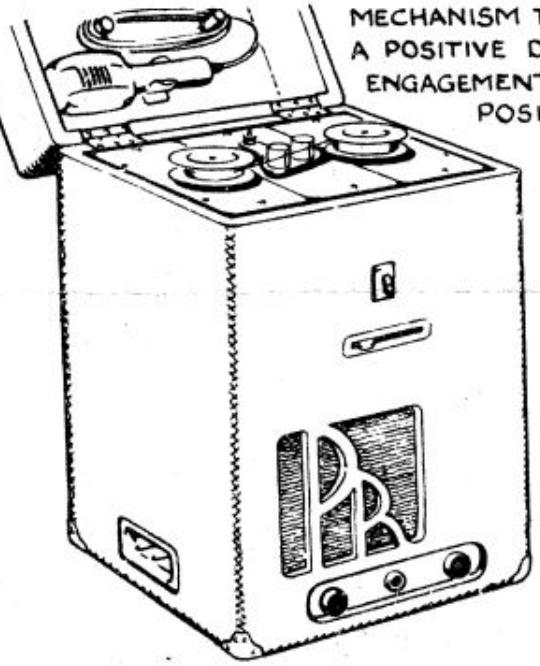


ILLUSTRATION ON LEFT SHEWS AN ALTERNATIVE SPOOL DRIVE. THE SWINGING LINK ENGAGES THE IDLER WHEEL WITH EITHER OF THE DRIVE WHEELS AS REQUIRED. THE SWINGING LINK (AND THE PIVOTED MOTOR PLATE IN ILLUSTRATION ABOVE) SHOULD IN BOTH CASES BE FITTED WITH A SPRING LOADED CATCH OR TOGGLE MECHANISM TO ENSURE A POSITIVE DRIVE ENGAGEMENT IN EITHER POSITION.



IT IS SUGGESTED THAT THE WIRE MECHANISM BE MOUNTED IN A CARRYING CASE TOGETHER WITH THE AMPLIFIER AND SPEAKER AS ILLUSTRATED ON RIGHT, THUS PRODUCING A SELF CONTAINED RECORDER UNIT. SPACE MAY BE LEFT IN THE LID FOR MICROPHONE AND POWER LEADS ETC. THE AMPLIFIER INPUT CIRCUITS MUST BE WELL SCREENED TO AVOID HUM, AND POWER LEADS KEPT AS FAR AS POSSIBLE FROM THEM.