

# REPAIR MANUAL FOR OLIVETTI PROGRAMMA 101

MUSEO DEL COMPUTER

Alberto Rubinelli

## 1 – What You Need

In order to work on a Programma 101, and maybe fix it, the first thing you need is a lot of patience, since you will have to work on very small, delicate details and in confined spaces. It is then necessary to have a table and space around it, as it will be difficult to finish everything in one session, and it is unthinkable to reassemble it every time, perhaps hastily. As equipment screwdrivers of various sizes and some wrenches, 6-7 and 8mm, preferably also, will be indispensable in the tube version, because in a couple of points they are practically indispensable. A soldering iron will be necessary for repairs on the electronic part, together with solder, tweezers, nippers and all the small equipment for electronic repairs. As instrumentation you need a digital multimeter, capable of measuring direct and alternating voltages and resistances. You'll also need some spray deoxidizer than what leaves a light film of lubricant, diesel oil, a can of compressed air or compressor available

## 2 – What you do NOT Need

When we are faced with an unknown machine, and which perhaps seems interesting, the first thing one might do is plug it in and turn it on: nothing is more wrong.

Electronic equipment almost all make use of power supplies internally, which power supplies they use electrolytic capacitors, which unfortunately have a particular problem. When the machines stand still for a very long time, and by a lot I mean over 5 years, the electrolyte inside the capacitors everything is deposited in one point, leaving either partially exposed or totally the internal electrodes, which are then wrapped aluminum sheets, separated by paper. Now, in more than half of the cases, as soon as it turns on, these capacitors short out, damaging them irreparably, sometimes with small explosions, sometimes simply swelling. Here you see a Programma 101's power supply capacitor which is visibly swollen and would have exploded when the machine is turned on for the first time.



For this reason it is important never to carry out the first ignition as you normally would, but power the appliance slowly, using a variable transformer (commonly called variac) or, in the absence of means, by connecting a normal incandescent light bulb in series with the device, in order to limit the initial current transient.

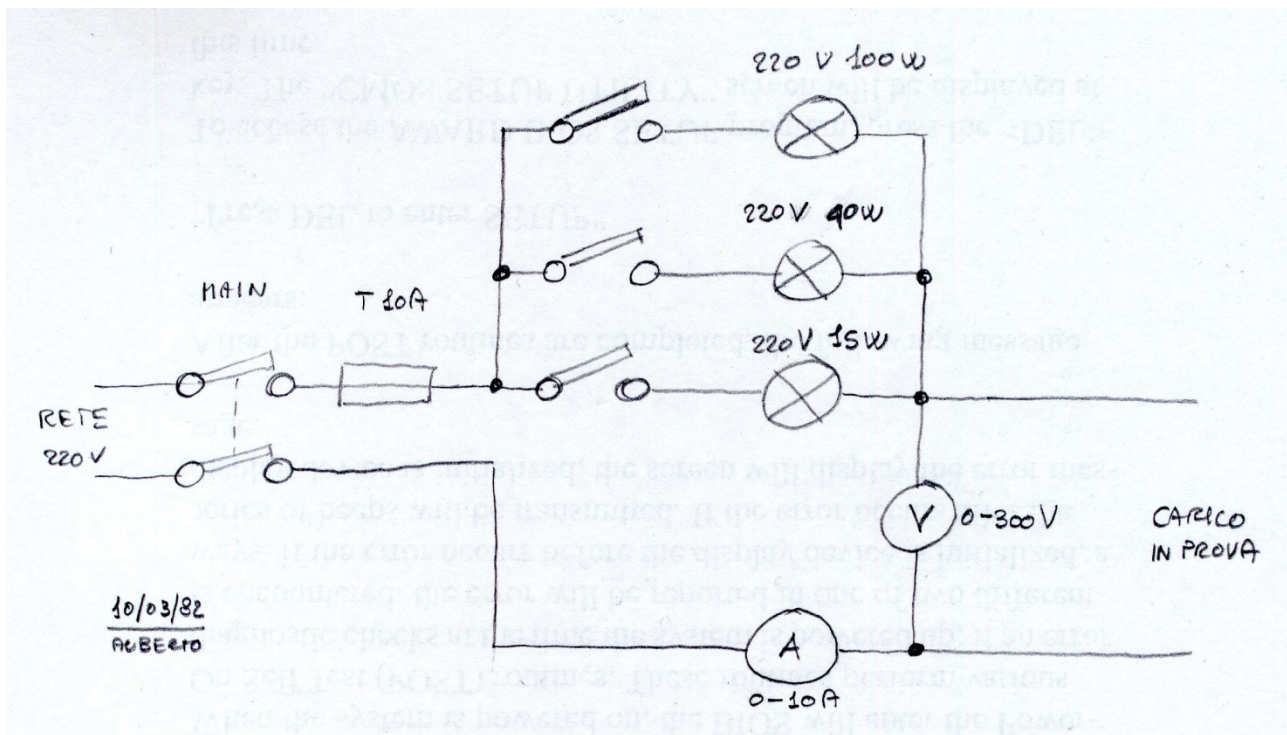


Above you see my variac, a more sophisticated version of the usual variable transformer. This is obviously the best solution, which allows you to properly dose the voltage of Power supply. The correct sequence is the following:

- set the variac to zero, then connect the machine and switch on
- slowly increase the voltage, keeping a close eye on the current: if it rises suddenly, turn off immediately and check what is on fire.
- When you hit 20-30 Volts, stop and leave everything in that condition for 20 minutes or more better half an hour. In this way you are reforming the electrolytic capacitors.
- At this point, slowly increase the tension. When you hit 100 Volts, you should see the engine start. If there is no abnormal absorption or smoke, continue up to 180 Volts, which are more than enough for a machine check. You will give full tension network only when you are sure that it works perfectly. Don't forget this machine was designed to be used at 220V and today the mains voltage supplied by Enel is of 230Volt.

If you don't have a variac, you can build yourself this small, easy-to-put on device together also with recovery components.





In the case of the Programma 101, and of all mechanical machines, there is another problem: if the machine is for some reason mechanically blocked, you risk damaging the engine or some parts of the mechanics, or in the best case of losing the synchronism of the movements, what this recoverable but which requires a certain amount of patience.

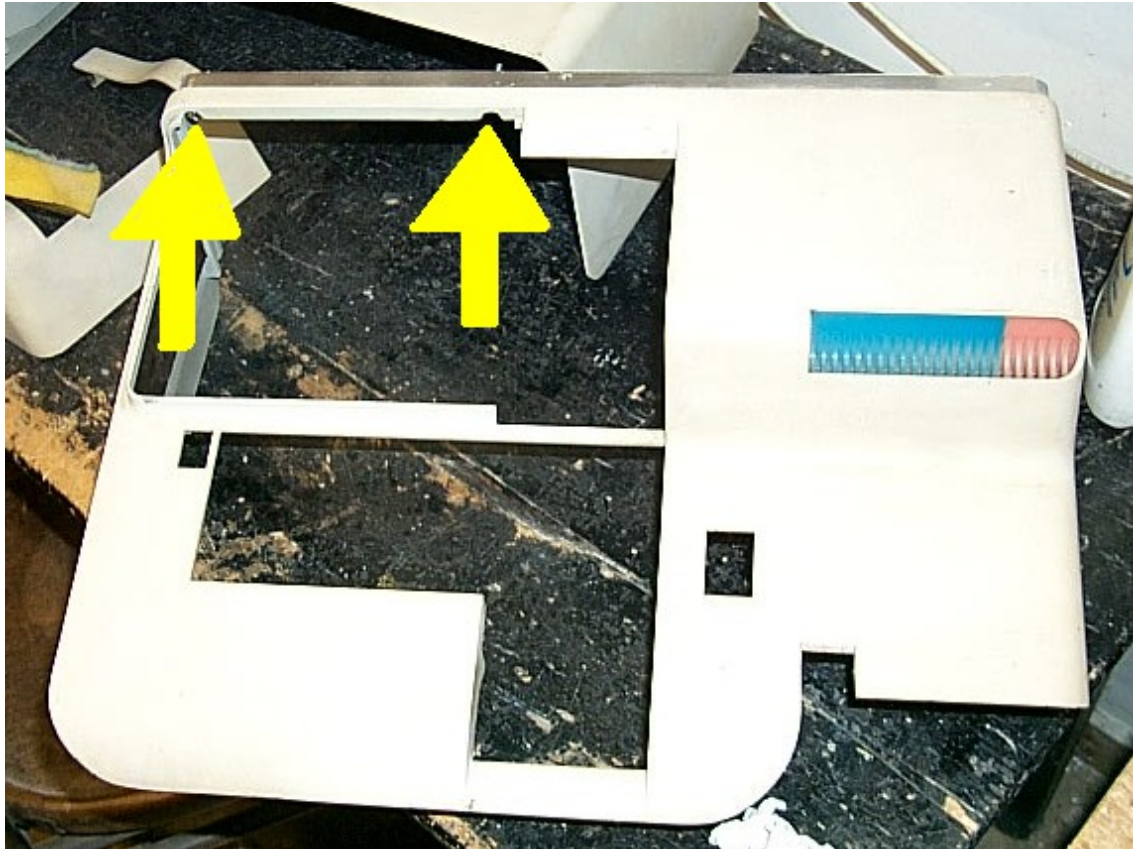
Sometimes, even following the soft start procedure (this is the name of the gradual start-up of the machine) it may happen that some components, almost always electrolytic capacitors, yes damage, so it will be necessary to replace them before taking any other action on the machine.

Another problem you may face is the liquefaction of the rubber belts that transmit the movement from the motor to the keyboard, to the printer and to the magnetic card reader: in this case, if the machine is not opened beforehand and cleaned well, using solvents suitable, as soon as you turn it on you have the result of "spreading" liquefied rubber, very sticky and extremely dirty, for all parts of the machine, forcing after a ten times greater job for the removal of dirt. In this case, once the machine has been opened, it will be necessary to clean all the parts contaminated by the loose rubber, as indicated later in the chapter "First interverts"

If you have not followed the precautions listed, you have brutally turned on your Programma 101, which worked perfectly, go play the lotto immediately: you will win!

### 3 - How to open the machine

Stand in front of the machine, this is where you start. Remove the lid that it also serves as a paper path, lifting and pulling it towards you at the same time. Be gentle, because we must never forget that we are dealing with a machine that at best it 40 years old. Once the print section cover is removed, lower your head to the height of the machine, then look inside the printer compartment, keeping your eyes parallel to the table top: you will notice two screws, which secure the rear cover. If you can't see them, help yourself with a small flashlight, an accessory that you put in a point of mechanics will be essential to you. In this photo I have indicated with two arrows where the screws are placed on a cover of the Programma 101 removed from the machine



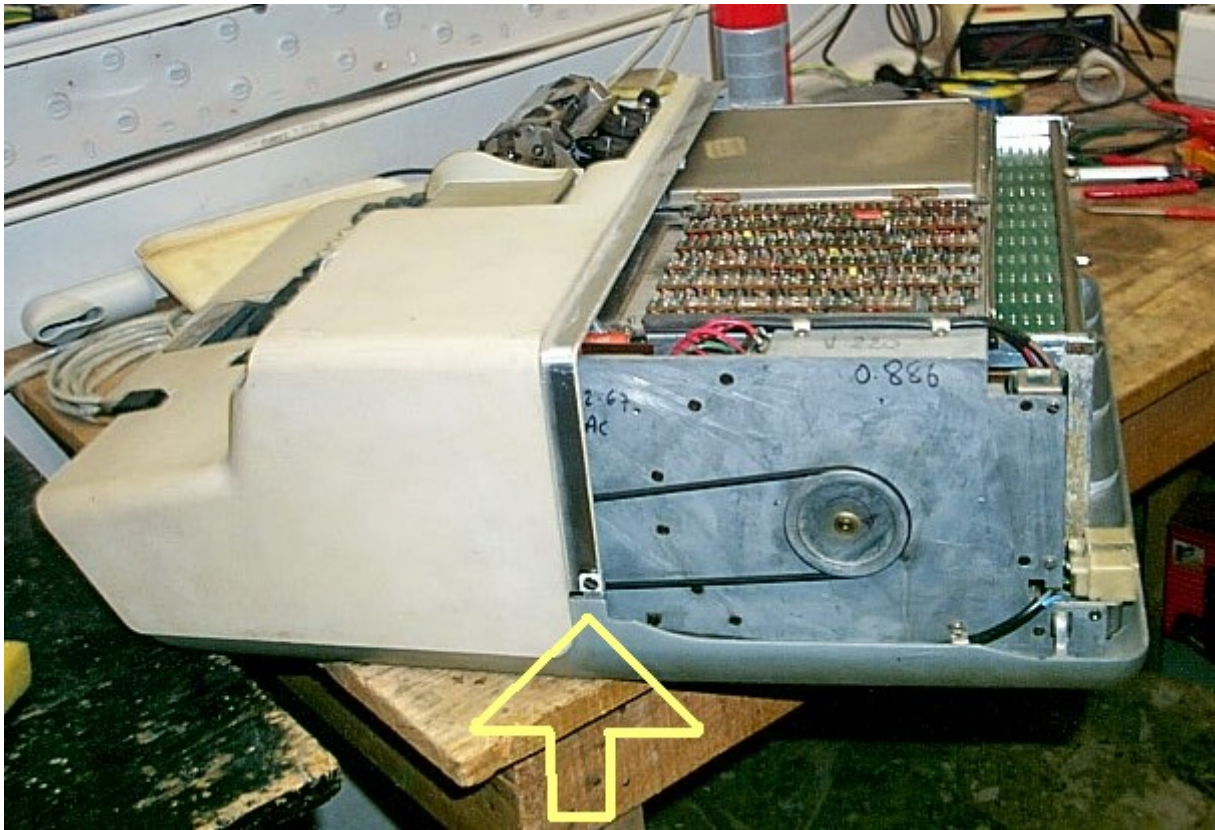
Unscrew these two screws, using a blade screwdriver of suitable length. You can then separate the back cover by sliding it back before lifting it. Do not try to lift it immediately; without it being moved back a couple of centimeters, otherwise you would risk breaking the guides. It is normal for some resistance when sliding back the cover, if the two supports of rubber are still intact and not liquefied. After removing the back cover you will find yourself in front of this show.



From this moment on, be very careful not to damage any of the internal parts, during disassembly operations: in addition to being delicate, some are no longer available. Another detail to which you must pay attention is not to wear absolutely synthetic clothes, of those that when you take them off you feel static. If you can't do without it, be careful to touch something metallic connected to the earth before touching the machine. The electronics of those years are really very sensitive to electrostatic charges, and it really takes nothing to puncture a transistor with its own static charge.

Having said that, let's continue with the opening of the machine: until now you have been in front of it, now that you have partially stripped it, look at it from the side, you will notice two screws, one on the right and one on the left, which hold the front of the lid. In the photo below, they are clearly indicated by the yellow arrow, in this case for the right side of the machine





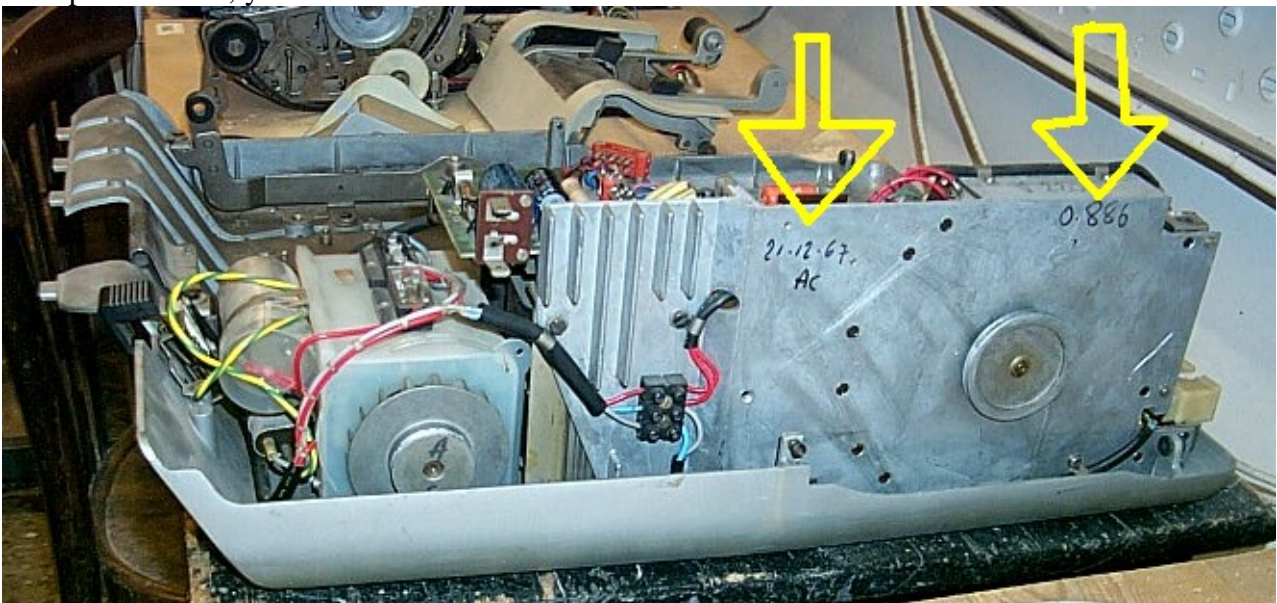
Once the two side screws have been removed, you can remove the front cover by lifting it from the back of the machine and pivoting it to the front, until it is raised enough to allow the front to release from the bottom shell of the machine. Everything is much easier to do than to say; also in this case, never use force, always try to be natural in the movements and if you feel something that strains, calmly move the parts, to try to unhinge them. Also removed the second cover, you have in front of the machine naked and raw and you can start to observe it, to become familiar with it.





The first thing you will notice, looking at it from the right side, is that on the power supply heatsink there is always written the serial number and the test date of the machine, all in felt-tip pen, not there were still barcodes, thermal labels and then we were in Italy and we made do with what was found. Don't forget that Programma 101 was designed as a poor product, which could not benefit from all the Olivetti technology, reserved at the time exclusively to the mechanical sector, which was the one that fed everyone.

In the photo below, you can see where the serial number and test date are located



You can observe the parts, extremely organized.



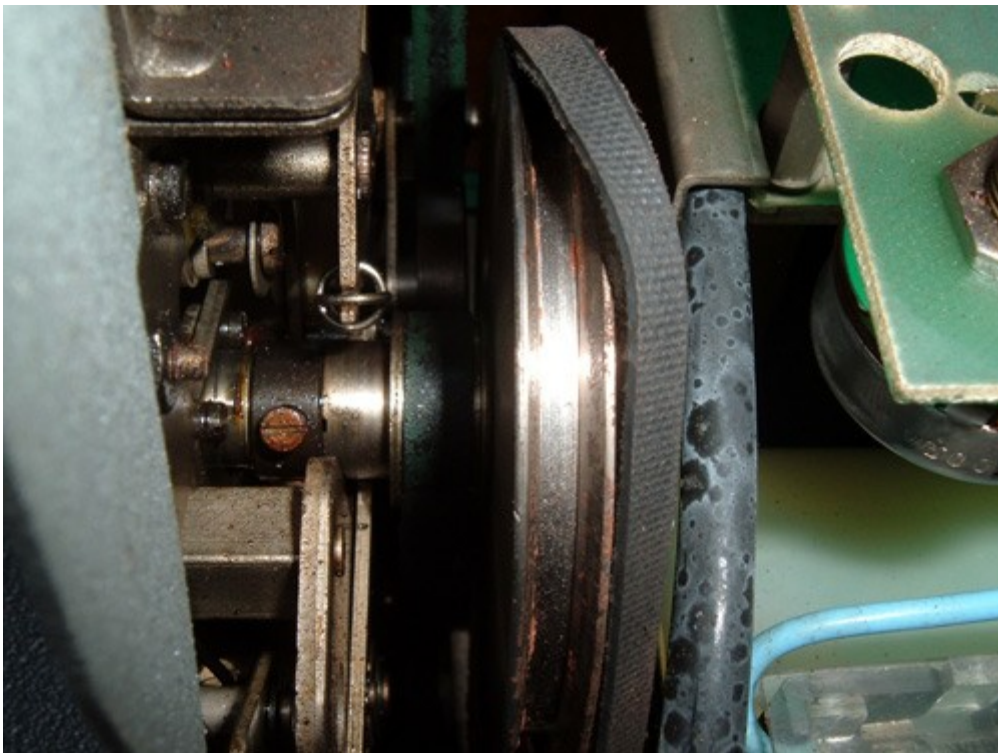
## 4 – First Steps

The first thing to do is to remove the dust. Never use a compressor right away, but first clean well with a vacuum cleaner and brush. Only when you have removed the bulk of the dust, you can then use the compressor to blow away the remaining dust, always helping you with a soft brush. The reason for this operation is soon explained: if the compressor is used initially, with a lot of dust deposited, you will only redistribute the dust and get it inside the mechanical mechanisms and in the area of the electronic boards, where instead it does not settle normally.

Once the dust has been removed, you must immediately check the condition of the belts. Usually not all will melt, but only those in non-cloth neoprene, while those cloth, similar to those for automotive use, as an example, normally resist. But to access the belts, except for the fan drive, you will have to partially disassemble the machine

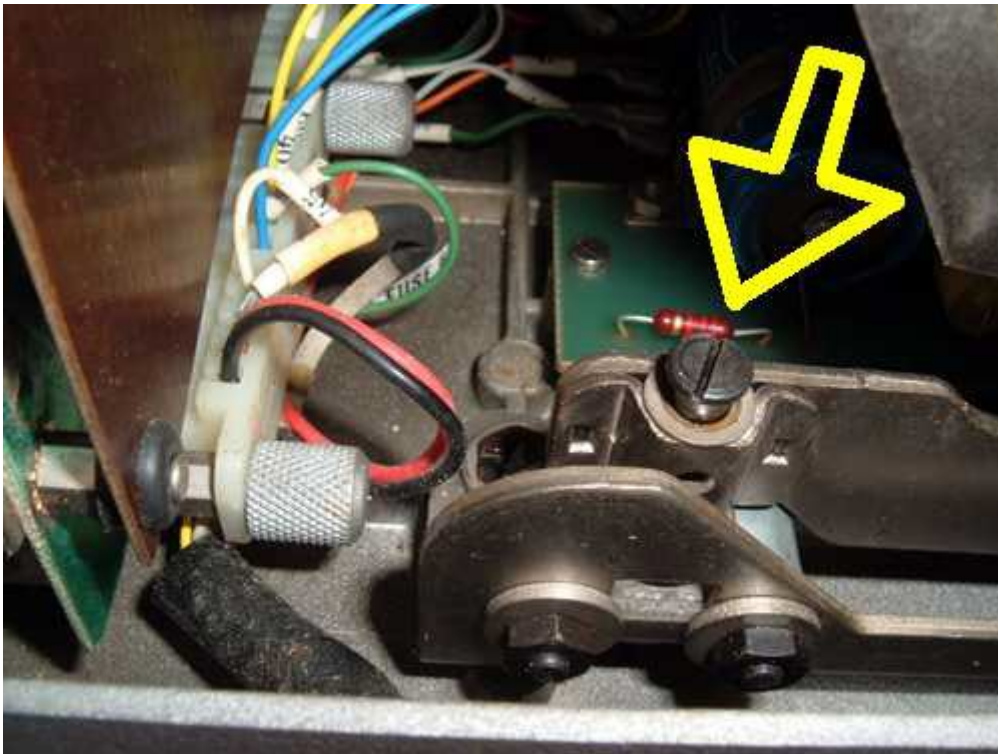
### 4.1 – Mechanical movement into service position

The first thing to do, when there is work to be done on the mechanics, is to put the keyboard / printer mechanism in the service position: in fact it, in anticipation of major maintenance to which it might be subjected to, was designed to tip forward, a bit like the cab of the trucks' engines. To do this, you must first remove the belt connecting the mechanical part to the motor, a 5mm wide V-belt, easily visible by observing the machine from above, between the keyboard and the motor. Locate it and remove it by derailing it from its largest pulley with the help of a blade screwdriver



Next, you have to remove the two screws that fix the mechanism to the base, by means of the adjustable anti-vibration mounts, a small mechanical masterpiece. Also in this case, take a look the mechanics from above, and at its rear corners you will see the two supports: remove the screws and you will be free to rotate the entire mechanical block forward.

In this photo you can see the left support, with the screw to be removed indicated by the arrow:



The other screw is identical, therefore easily identifiable, and is located on the right side of the mechanism, at the same height and depth as this one.

At this point the mechanics can be lifted very delicately, which will pivot on the two front supports, and will overturn towards the front of the machine; this operation will obviously be only possible if you have previously released the main belt of the machine.

In doing this, pay particular attention to the cables that connect the various parts, that there are none that causes impediments; the most delicate cable is that of the card reader head magnetic, a small gray shielded cable, which is free to move as it is not bundled together with the other cables.

Here is what the Program 101 looks like with the mechanics in the service position:



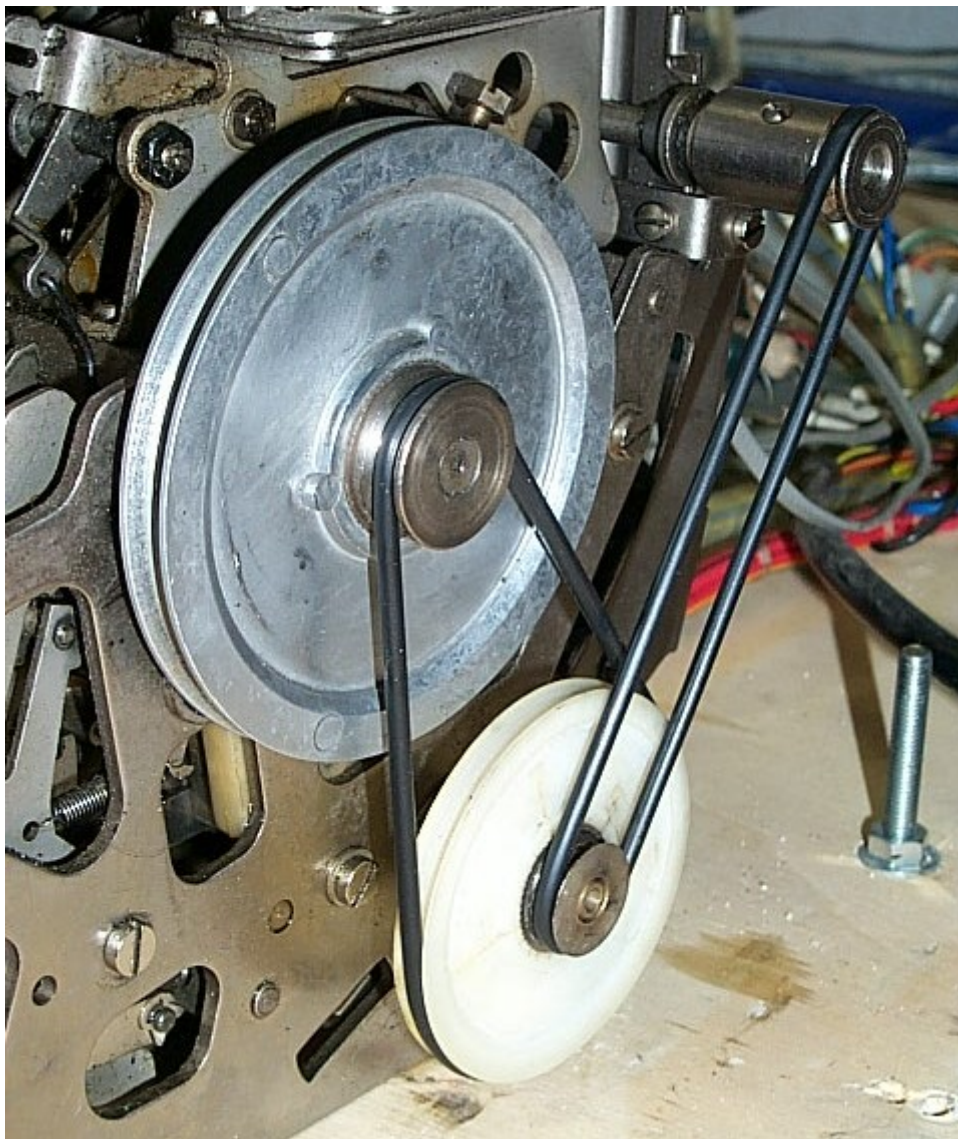


## Keyboard lock

First of all, a short explanation: what is the keyboard lock for? It looks like one which is useless, or rather, out of place, since Programma 101 is not a mobile phone that you put in your pocket and can accidentally take the pressure of the keys. In the management system of the Programma 101, one of the hardest things to do is memory. Even a stupid memory cell, it needs complex circuitry. For this reason the keyboard is not "buffered", ie if press a key while the machine is still performing the operation required by pressing the previous button, a mess happens. So here is the keyboard is locked until the operation is not completed. In practice, you are allowed to type, only when the machine can receive your instructions.

Now, if the locking system does not work, that is, the keyboard remains locked even with the machine fully operational, there can be few causes. The most common is that the movement to the mechanics of the keyboard, as a result of a broken belt, or rather loose. So it is necessary to check immediately that the belts that set the mechanics of the keyboard are intact. Then check the two belts that transmit the motion to the part of mechanics of the keyboard, which is the one between the magnetic card reader and the printer.

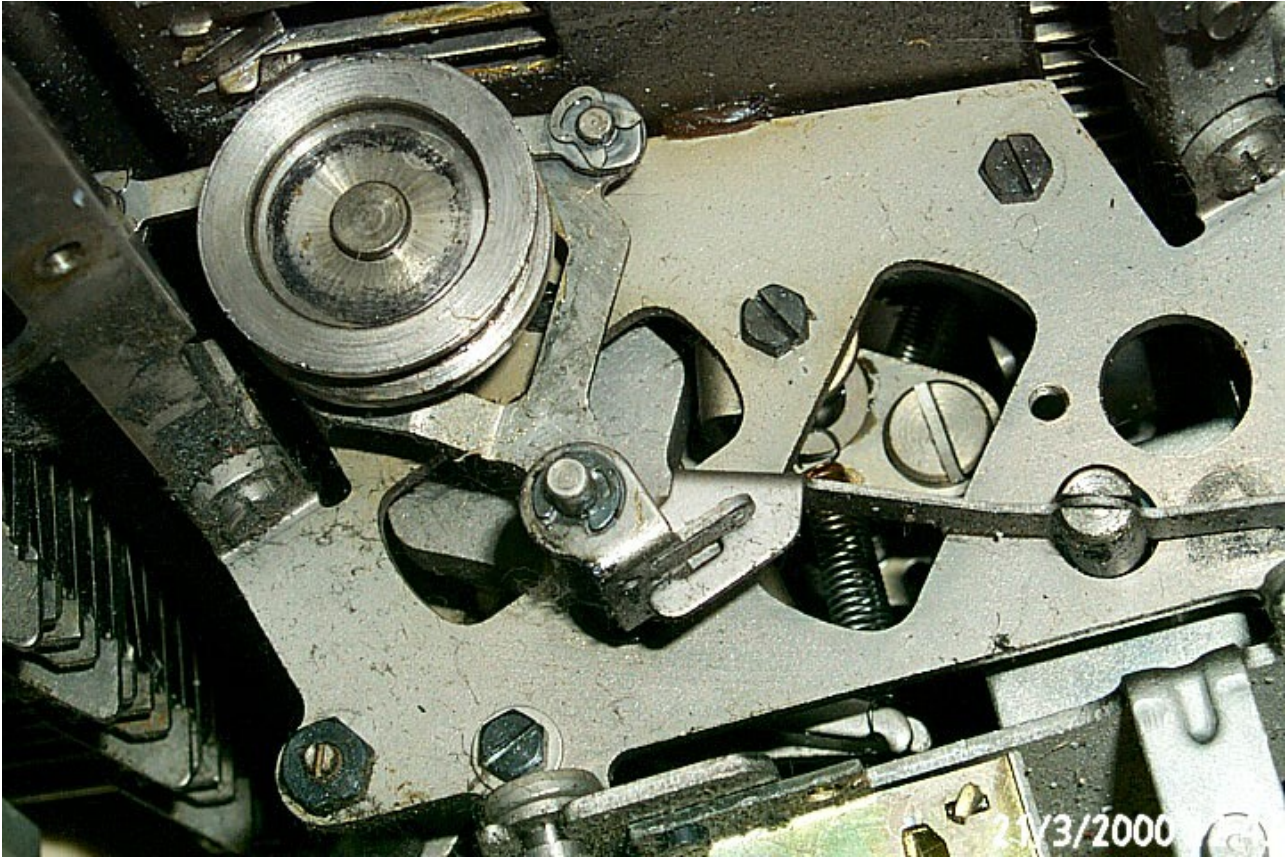
Below you can see what the belt system should look like



Another reason is the malfunction of the release mechanism, driven by an electromagnet. It is a servomechanism, where the force used for the release comes from the rotation of the



main motor, while the unit is powered on. In practice, an electromagnet attracts, for a moment, an anchor which takes a crank and hooks it to a wheel, which turning causes it to unlock. All this kinematics is used to move the mechanics of the keyboards with a certain force, employing however a minimum effort, that of an electromagnet. Unfortunately the latter is not very visible, at least until the printer part is removed. Here in the photo you can see a detail of this mechanism, photographed however without the printer part mounted.



The third reason why the release mechanism may not work is a mechanical parts seizure. In this case it is advisable to wash the mechanism well with diesel oil, then dry with compressed air: do not use other solvents, they would irreparably damage some plastic parts. There would be a further possible cause of the malfunction, namely the electromagnet that does not receive current, but in this case it means that the electronics are faulty, therefore the keyboard lock would be a much more minor consequence of the main damage.



## The belts

The belts of the Programma 101 are five in total. Let's start talking about the least important, the one that drives the power supply fan. It is a rather long strap, which you will find loose because it is one of those in neoprene or maybe butyl rubber, I don't know. I was saying that it is not very important, because if the fan runs a little slower or a little louder, nothing bad happens; the important thing is that it turns, otherwise you risk roasting the feeder, too if there is a thermostatic protection, which however, given the genre, intervenes when the semiconductors they have already exhaled their last breath.

Here is the fan belt (for now I can't find a photo with the belt mounted):



This belt can be replaced with an O-Ring thickness and diameter is 3mm

Here is a photo of the other two round belts:

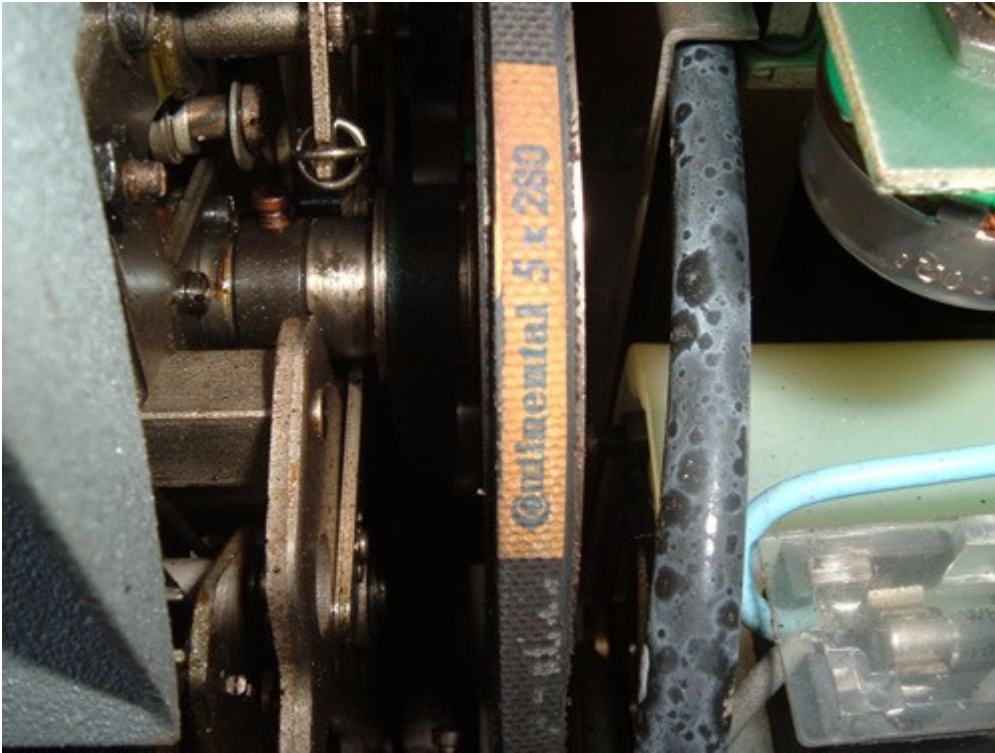


The one on the left transmits the motion from the main flywheel to the pulley which acts as a return and turns the pinch roller of the magnetic card reader. The one on the right constitutes a return of the



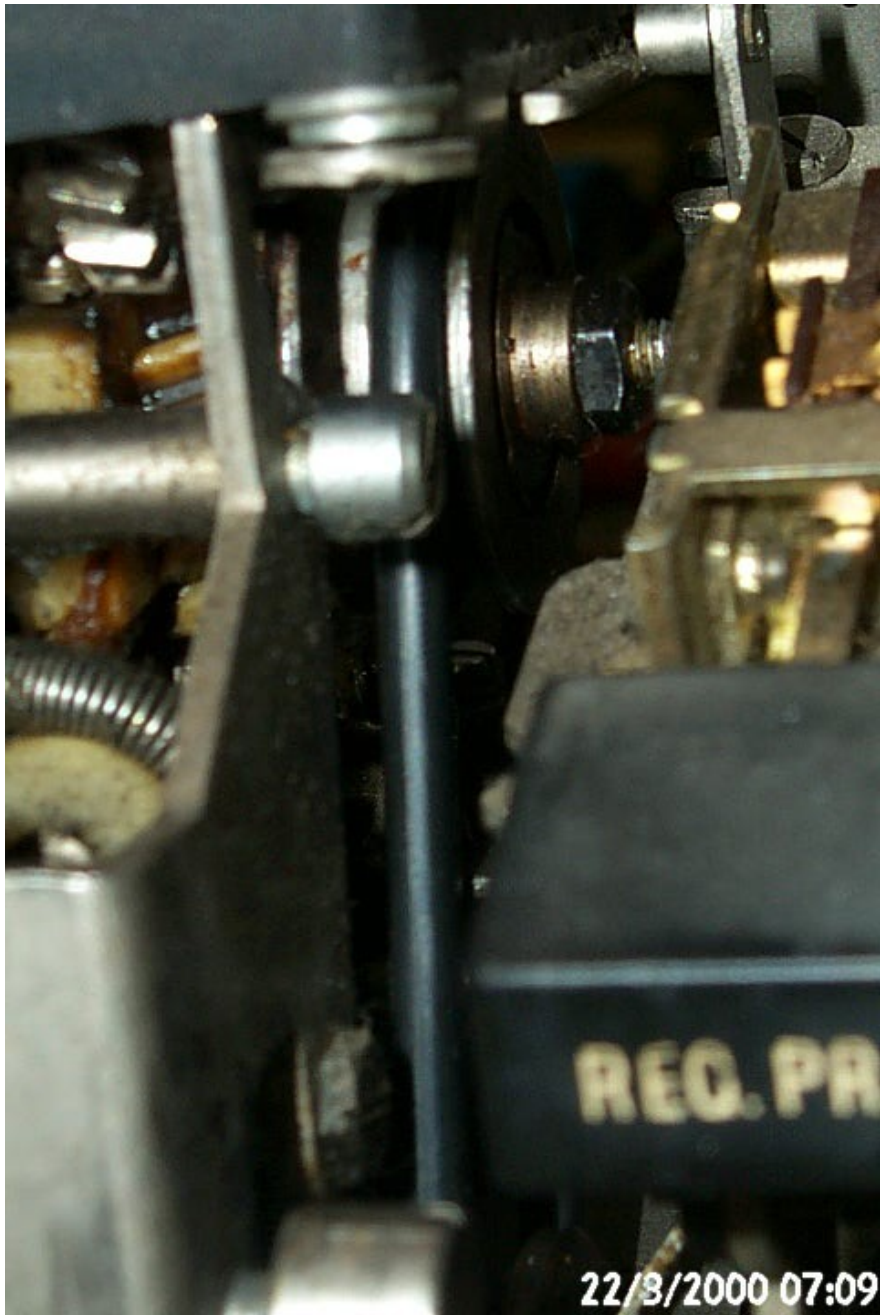
motion for another guide roller of the reader, in fact it has a 1: 1 ratio, having to be dragging at constant speed.

Here is the main drive belt, the one that carries the motion from the motor to the main flywheel:



It is a 5mm x 280 development V-belt from Continental. If you need to look for it today, remember that the parts from Continental that makes belts today is called Contitech, and it is still operational. But this belt hardly gets damaged over time.

And here's the printer belt instead:



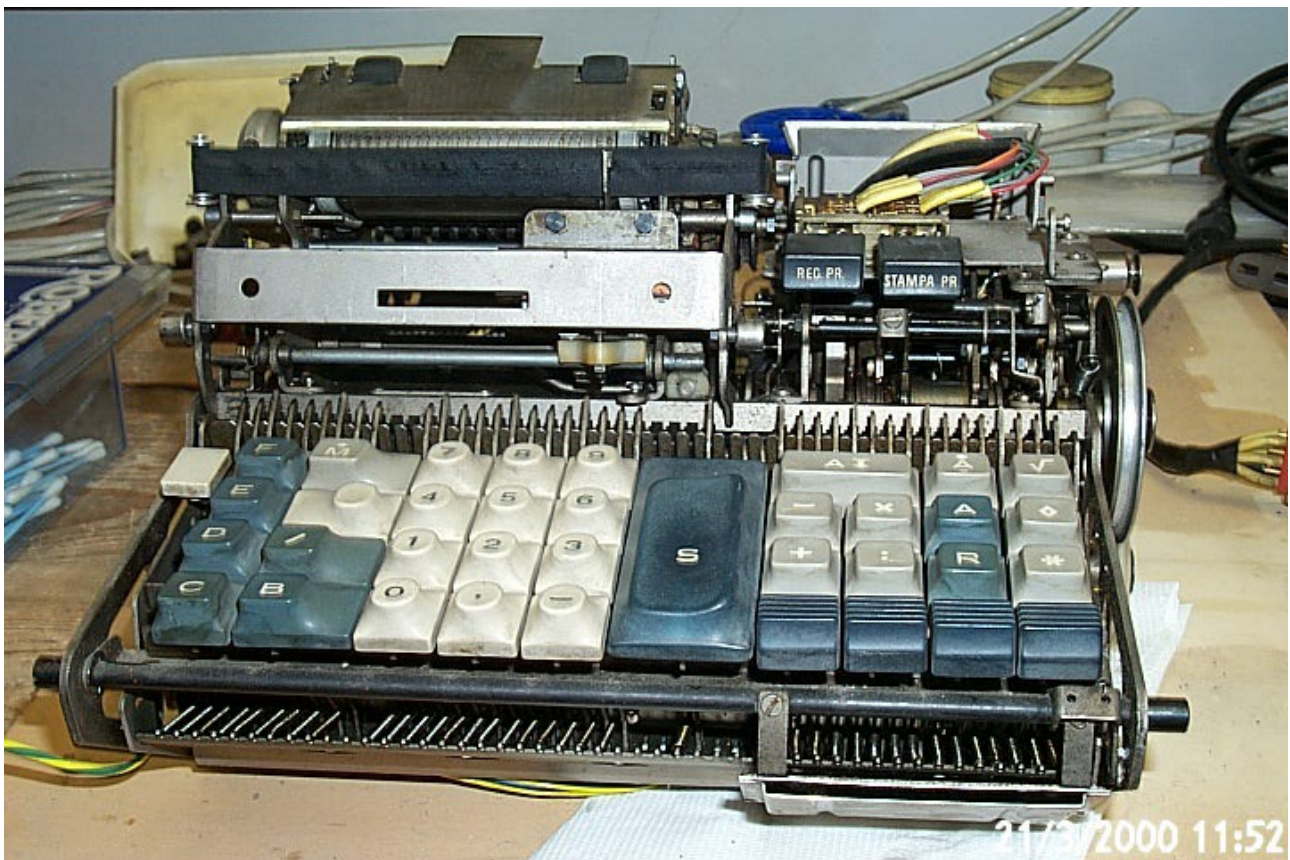


## Separation of the printer mechanics.

When it is necessary to intervene on the mechanics of the printer, or, much more common case, when it is necessary to replace the belt that transmits the motion to the printer, the block must be removed printer from the one that contains keyboard and card reader.

To do this you need some careful attention, because you have to remove the 4 right screws, avoiding loosening others unnecessarily: the printer mechanics have adjustments, which if tampered with would forever compromise the press, precisely at best it would be achieved a print on one side of the light paper and dark on the other.

Here is the mechanics of the printer mounted in its place



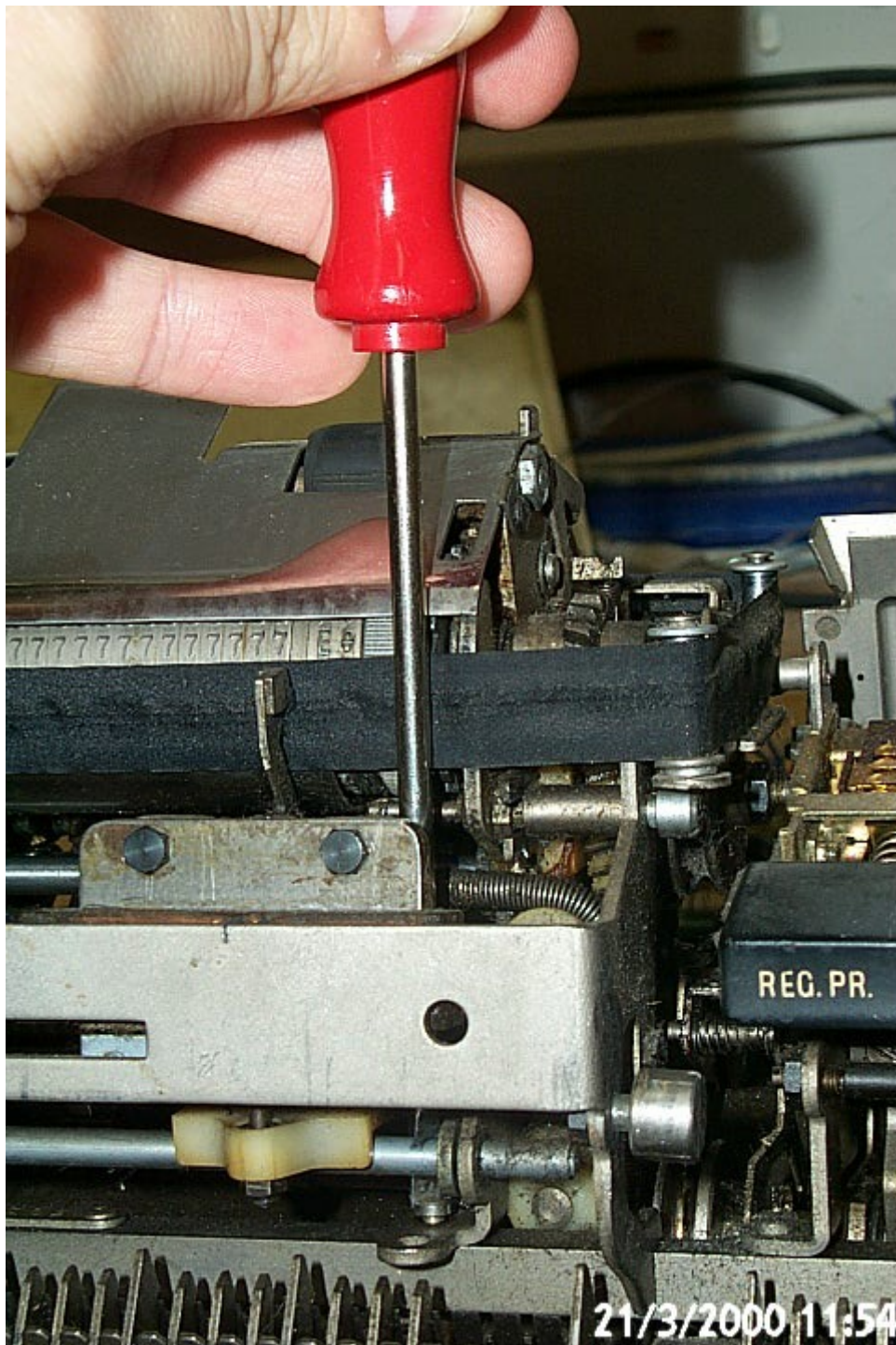
As a first step, you need to disassemble the two tape magazines. There is no need to take it off completely, just lift the coils in turn when unscrewing the affected screw.

Let's start with the removal of the two front screws. You need a 4mm blade screwdriver. In the following photo, you can see where the first screw is located, the easiest of all



The second screw is also not difficult to remove:





Let's move on to the two rear screws, which are a little more difficult to remove, but not impossible, the important thing is to always work calmly.

Here is the first of the two rear screws



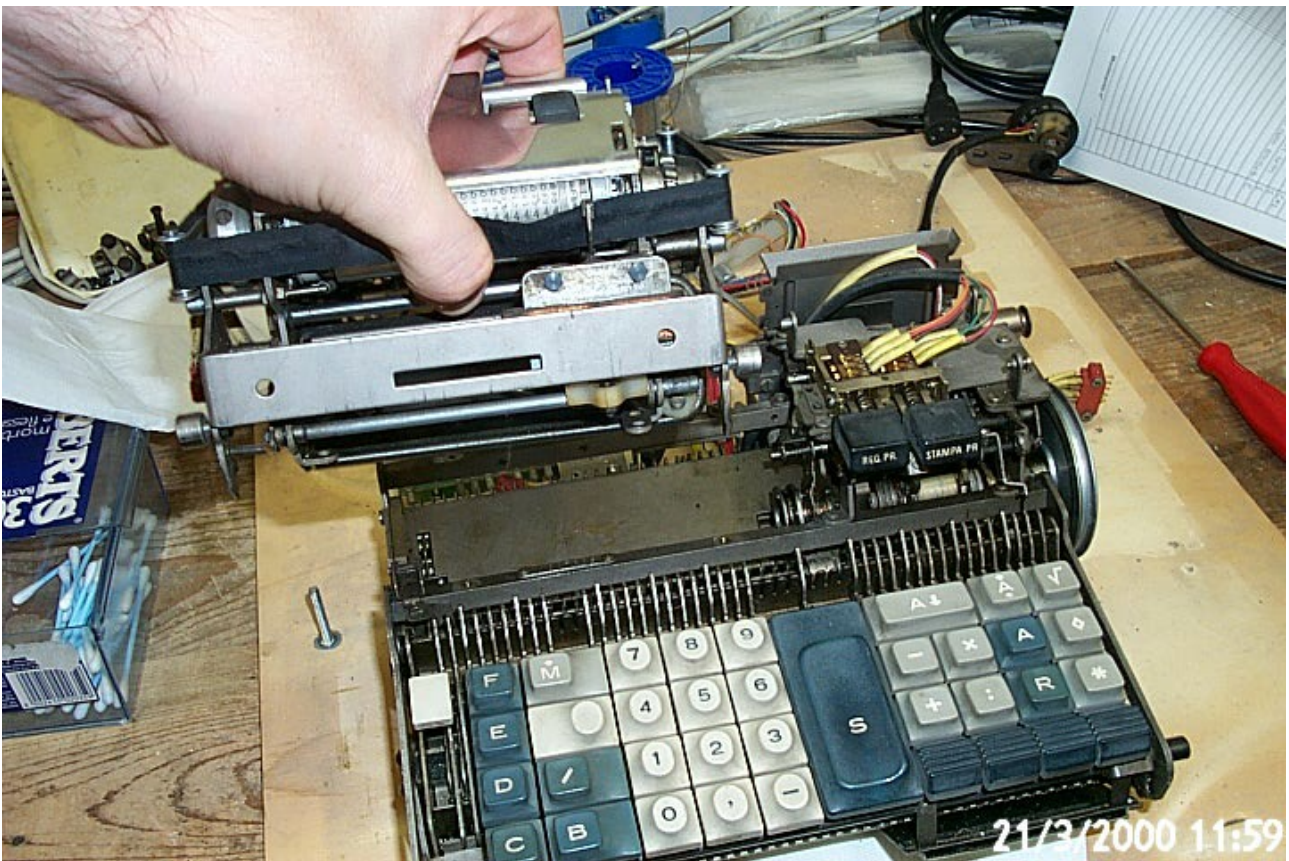


And here is the second rear screw, the last, perhaps the most inconvenient, to remove which is necessary to work a little blindly:

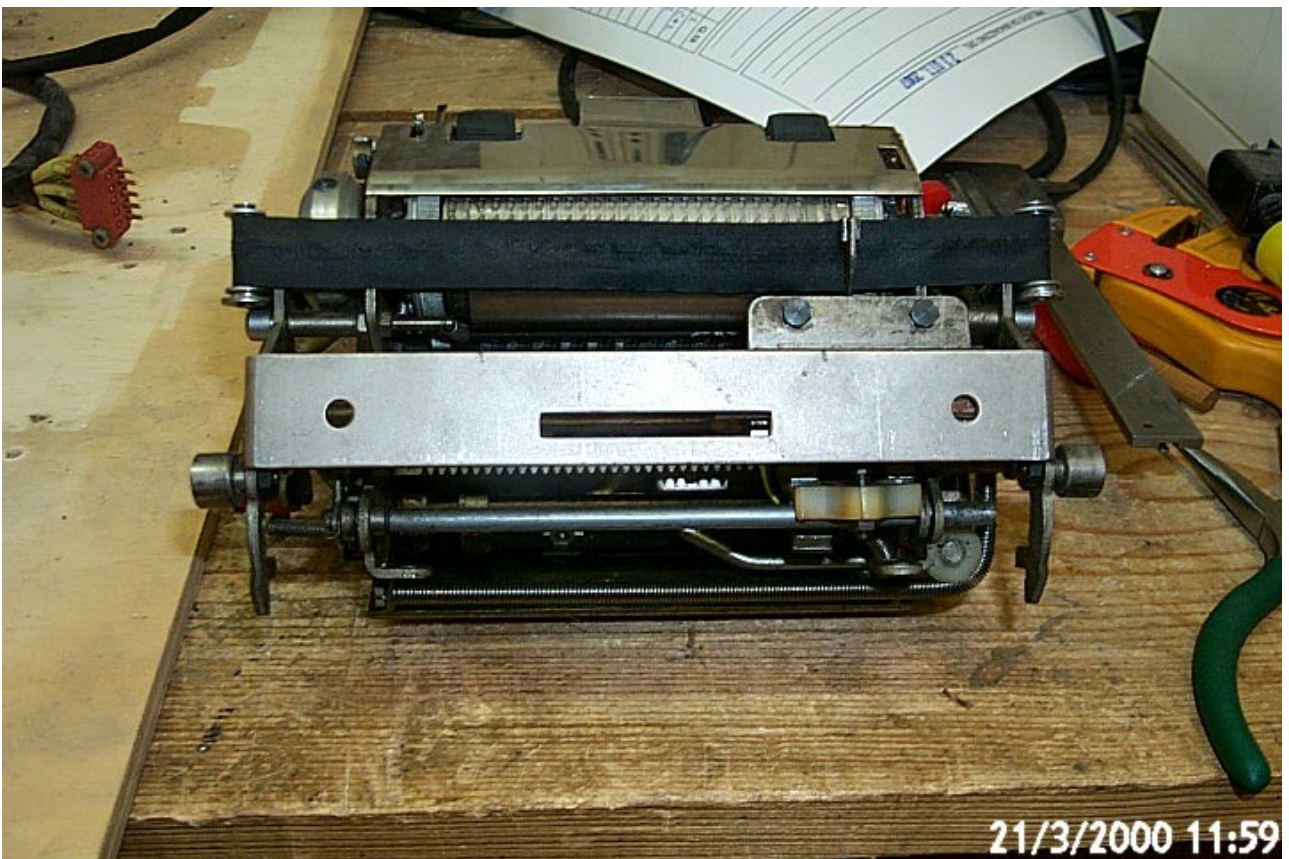


At this point, you can gently separate the printer mechanics from the rest of the machine:





And here's what the mechanics look like isolated from the rest of the machine



You can now dedicate yourself to its cleaning, which is well done, since it is the part of the machine that is dirty more, both because it is the one in contact with the outside, and because the paper tape passes through it, which it can release dust, both because there is the tape that it too can release dust and fibers.

It is advisable initially to remove visible dust and dirt, with rags, cotton bud brush, then perform a good cleaning with the compressor, taking care not to use high pressure air, then use flux, if necessary, in the parts that were particularly inked. Then move on to diesel lubrication of the slides and all parts mechanics that have to move. Check, moving the system by hand, that it is fluid and there are no impediments. After lubrication, always remove excess diesel oil with the compressor, only a thin film must remain, which has the dual function of lubricating the mechanics and to prevent rust oxidation.