Mills DIAL

Supplement

to

Owner's Complete Guide to the Mills Q.T. Slot Machine

by Rick Akers

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Chapter 1
Introduction

David Saul and Robert Geddes wrote "**Owner's Complete Guide to the Mills Q.T. Slot Machine**". It's an excellent book detailing the Mills Q.T. slot machine, describing a brief history of the Q.T. family, theory of operation, maintenance, tear down, and assembly of the mechanism.

They did not cover, in detail, the Mills DIAL machine. The DIAL is part of the Q.T. family, but is much more different than all of the other "Q.T." machines. It's the only one that doesn't have a payout. It's strictly for amusement, or so Mills would like some people to think. Without the payout slides and associated hardware, but with a rotating dial depicting a map of the globe and its associated hardware, the DIAL is a very different machine.

Figure 1-1

Figure 1-2

After I bought my DIAL, I started looking for any information I could find about this fascinating machine. My DIAL mechanism had a lot of surface rust and I knew I was going to have to completely tear it down to clean everything. I have most of the "Owner's Complete Guide to ??? Slot Machine" books and was hoping someone had written an "Owner's Complete Guide to the Mills DIAL". No such luck. However, Roger Slocomb, a fellow collector I met through the Coin-Op Collector Forum, told me about "**Owner's Complete Guide to the Mills Q.T. Slot Machine**". That was one that I didn't have. It had enough information in it to get me started. Using it, and shooting a lot of pictures of my DIAL mechanism, I was able to tear down my mech, clean it, and put back

together. During this process, I thought; it sure would be nice if someone had documented this for other DIAL owners to use. That's what this supplement is all about.

First, I hope I'm not stepping on any legal rights of the owners of "**Owner's Complete Guide to the Mills Q.T. Slot Machine**". I don't have any information that's in "**Owner's Complete Guide to the Mills Q.T. Slot Machine**" in this supplement. This is a supplement and not a stand-alone document. To use this supplement, you will need a copy of "**Owner's Complete Guide to the Mills Q.T. Slot Machine**". Copies are still available through the Internet. Just do a search. When I refer to "the book", I'm referring to **Owner's Complete Guide to the Mills Q.T. Slot Machine**". For theory of operation not specific to the DIAL, please refer back to "the book".

It's nice to know that all of the paper; reel strips, award card, plane and planet flag strip, numbers strip, and map are available. I got everything except the numbers strip from Dave Berten (mrslot1@aol.com) and everything is excellent quality. I later found out that Rick Frink, 2977 Eager, Howell, MI 48843 has the numbers strip and everything else, also excellent quality. You'll have to send Rick a letter, he's not on the Internet.

I plan to make my information about the DIAL available for free. I will keep an updated copy of this Mills DIAL Supplement posted for everyone to download. If I make a revision, the new revision date will appear under the publish date on the previous page. My email address is there too.

Figure 1-3

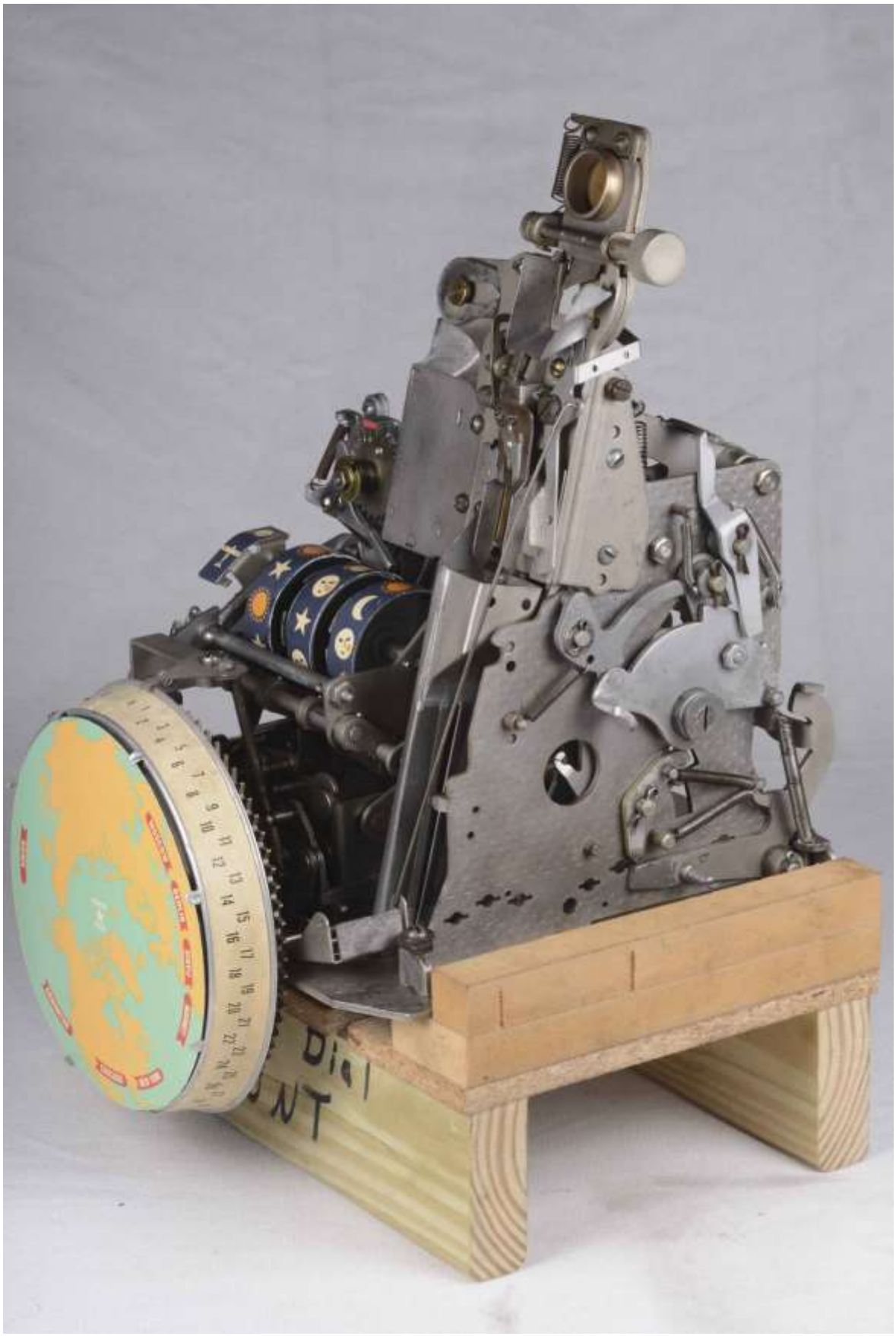

Figure 1-4

Chapter 2

The DIAL: Historical Background Introduction

The DIAL first appeared in an ad in Automatic Age magazine in February 1935. It was a very telling ad, describing how the DIAL worked. Special thanks to IAM, http://www.arcade-museum.com/ for these pages.

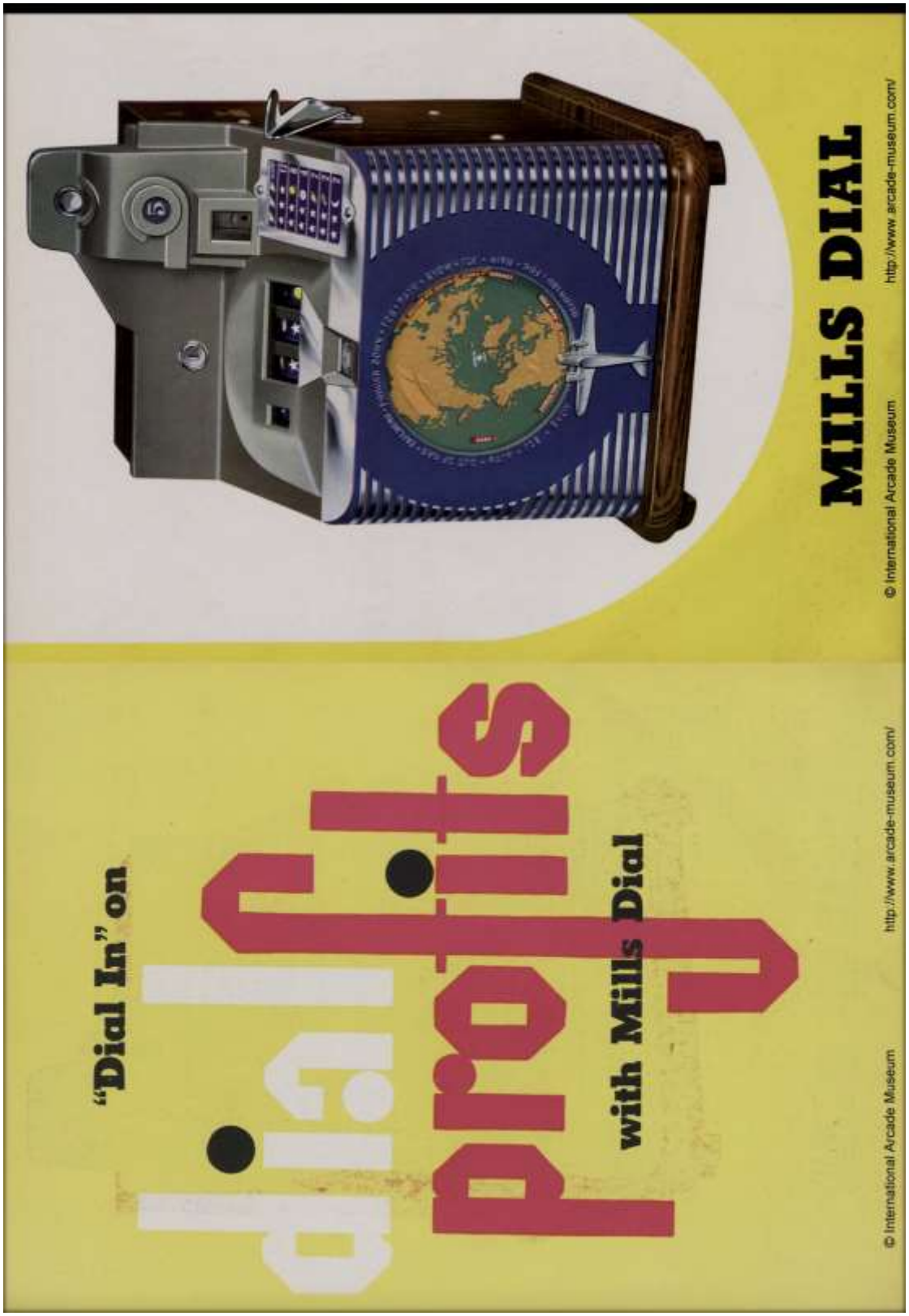

Figure 2-1

One of the most interesting trade-stimulators developed recently is the new Mills Dial. It does everything the Q.T. Bell will do, but has been designed for operation in territory where automatic payout machines cannot be used.

The Dial is a real game, with a reason. It takes the player on a mythical aeroplane trip around the world, covering the points touched and passed over by a famous 'round-the-world flyer. The same hazards and accomplishments are encountered in the operation of the machine as were encountered in one of the 'round-the-world flights. For example, just before reaching Nome, Alaska, head winds or tail spins are encountered, which set the player back a certain number of points, which handicap must be overcome on subsequent operations. There are other handicaps, such as rain, fog, ice, snow, force-down, etc.

There is tremendous action in every play. The player is either advanced or retarded on each operation. The revolving indicator disc is set in blue skies. The various heavenly bodies are represented in the design on the front casting, and this design is carried through on the reels. Even the Jackpot feature is blended into the 'round-the-world flight idea.

How "Dial" Operates

The player deposits a coin and pulls down the handle, setting the three reels in motion. After the reels stop, if an advancing set of combinations appear, the large dial indicator moves to the number of points advanced. As soon as points are shown on the large dial, the machine will not accept additional coins and will automatically return any coins deposited. It will operate free until all points on the dial have been lost by the player. Each unsuccessful operation moves the dial back one point. Each successful operation advances the indicator 2, 4, 8 or 12 points.

When the Jackpot combination appears, a small flag visible through a separate opening to the right of the reels appears.

When the player discontinues the game while there are still advances showing on the register, the storekeeper can issue prizes for points not used, but before doing this, he pushes in and turns a knob in back of the machine. This action automatically clears the indicator, returning it to zero, and registers the number of points on a special register inside the machine, accessible only to the operator.

The Jackpot registers separately on a numbered ratchet. The Jackpot flag disappears when the storekeeper pushes in the knob in back of the machine.

The Dial Machine is built in typical Bell machine style. The general outline of the case is practically the same as that of the famous Silent Jackpot Bell.

The mechanism used is practically identical with that used in the Q.T. Machine, excepting it has no payout slides and is equipped with a special registering device which records all points on which prizes have been awarded.

The Dial is equipped with a large cash box, sufficient to take care of a week's play in any average location. The machine is built fool-proof in every particular, cannot be manipulated, and entirely eliminates the necessity of the operator's taking the merchant's word for merchandise given out in connection with the machine.

Figure 2-2

Chapter 3
DIAL Components

Map Plate

The map plate is a flat metal disc held to the numbers disc by 8 folding tabs, Figure 3-1. A paper copy of the DIAL map is glued to the map plate. Special care should be used when prying the 8 tabs back far enough to remove the map plate. Be very careful not to break off any of those tabs on the numbers disc, Figure 3-2.

Notice on the back side of the map plate in Figure3-2 the small tab sticking up? That tab is used to prevent the map plate from rotating on its own when mounted to the numbers disc. That tab goes in the hole created by the folding tab at the one o'clock position on the numbers disc (See arrow in Figure 3-2). The hole, in the numbers disc about an inch inside that particular tab, can be used as a reminder to which tab hole to put the map plate tab. **NOTE**: The four pieces of tape with 11, 3, 5, and 9 were notes for me during dismantle. Same with the piece of tape on the back side on the map plate.

Figure 3-1

Numbers Disc

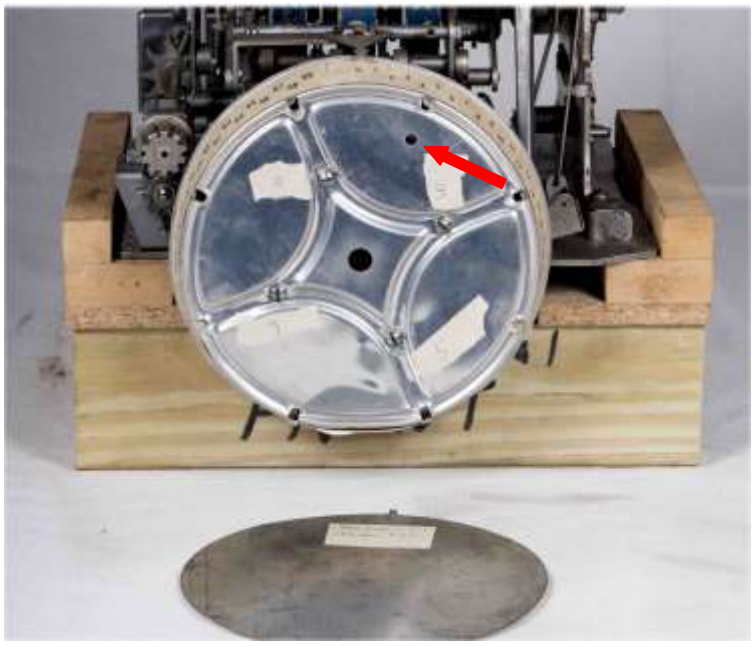

Figure 3-2

The numbers disc holds the map plate and has the numbers strip glued to its edge, Figure 3-2. The numbers show you how many credits you have won and show up in the numbers window just below the reels window.

There are four screws holding the numbers disc to the gear ring.

Gear Ring

The gear ring keeps track of how many credits you have earned, Figure 3-3. It works with the credit detection finger to determine if you have any credits to play. If the numbers disc was in the zero credits position, the round tab on the gear ring should be at the three o'clock position. Remember this as a reference when putting it back on. There are two posts on the back side of the gear ring (not shown). The longer post releases the credit turn rod when all credits are erased. The shorter post activates/deactivates the freeplay linkage up to the coin head. There are three screws holding the gear ring to the hub.

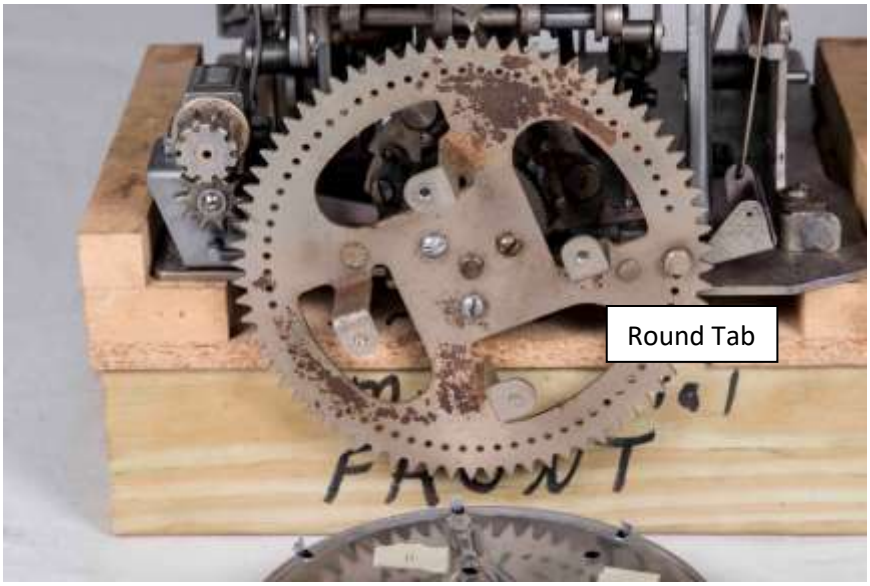

Figure 3-3

I put the three screws holding the gear ring back in their holes on the hub, Figure 3-4. You will notice, on the hub, there is an extra hole. The extra hole is not threaded for a screw. I have no idea why that hole is there.

Figure 3-4

Reel Assembly

The reel assembly is very similar to the Q.T. reel assembly. The only difference is the jackpot linkage and jackpot flag on either side of the left frame wall, Figure 3-5. If you remove the reel assembly, pay special attention to layout prior to removal.

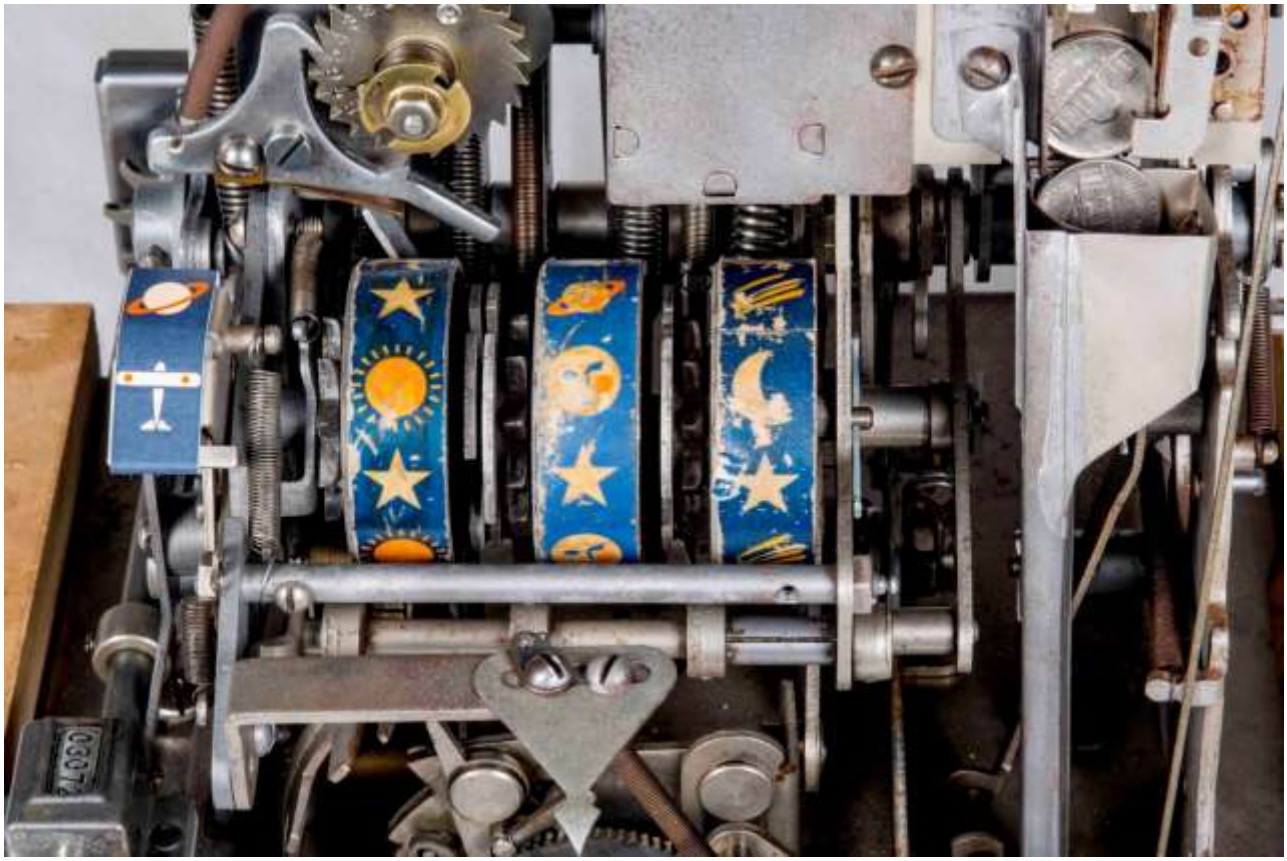

Figure 3-5

Credit Advance Block

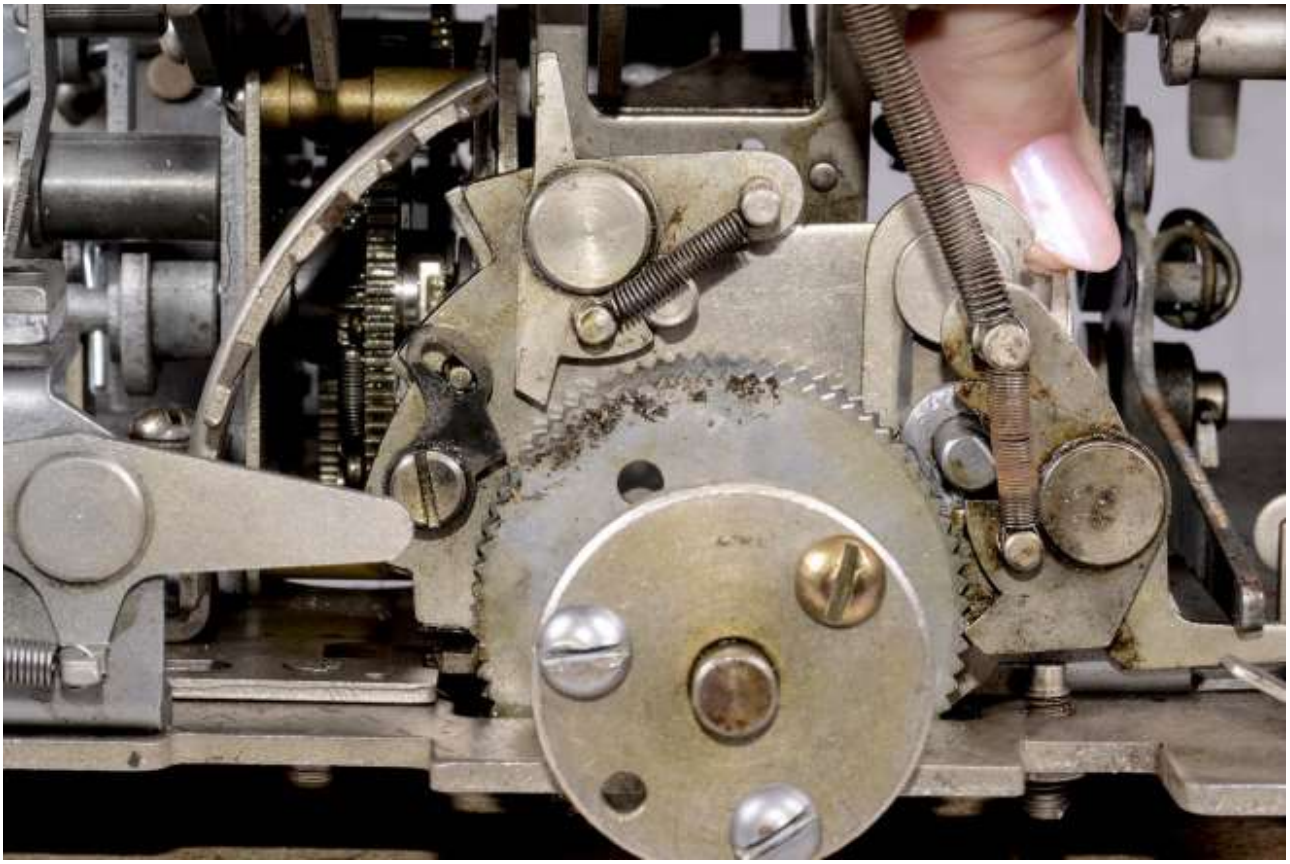

Figure 3-6

The credit advance block is a shaft with two gear wheels attached, Figure 3-6. At the front of the shaft is the hub where the gear ring is attached. Since both ratchet wheels are attached to the same shaft, they act as one. The front ratchet wheel has one pawl, to the right. Also attached behind the rear ratchet wheel is the payout step gear that has two pawls attached to it. That good looking finger is pushing down on the sliding reset lever that sits just behind the credit advance block.

To remove the credit advance block, remove the two screws from under the bed plate. One is attached to the front block and the other to the back block. You may have to remove the sliding reset lever, the advance block lever, and the front ratchet pawl first. It may also help to remove the reel bundle too.

Advance Block Hold Lever

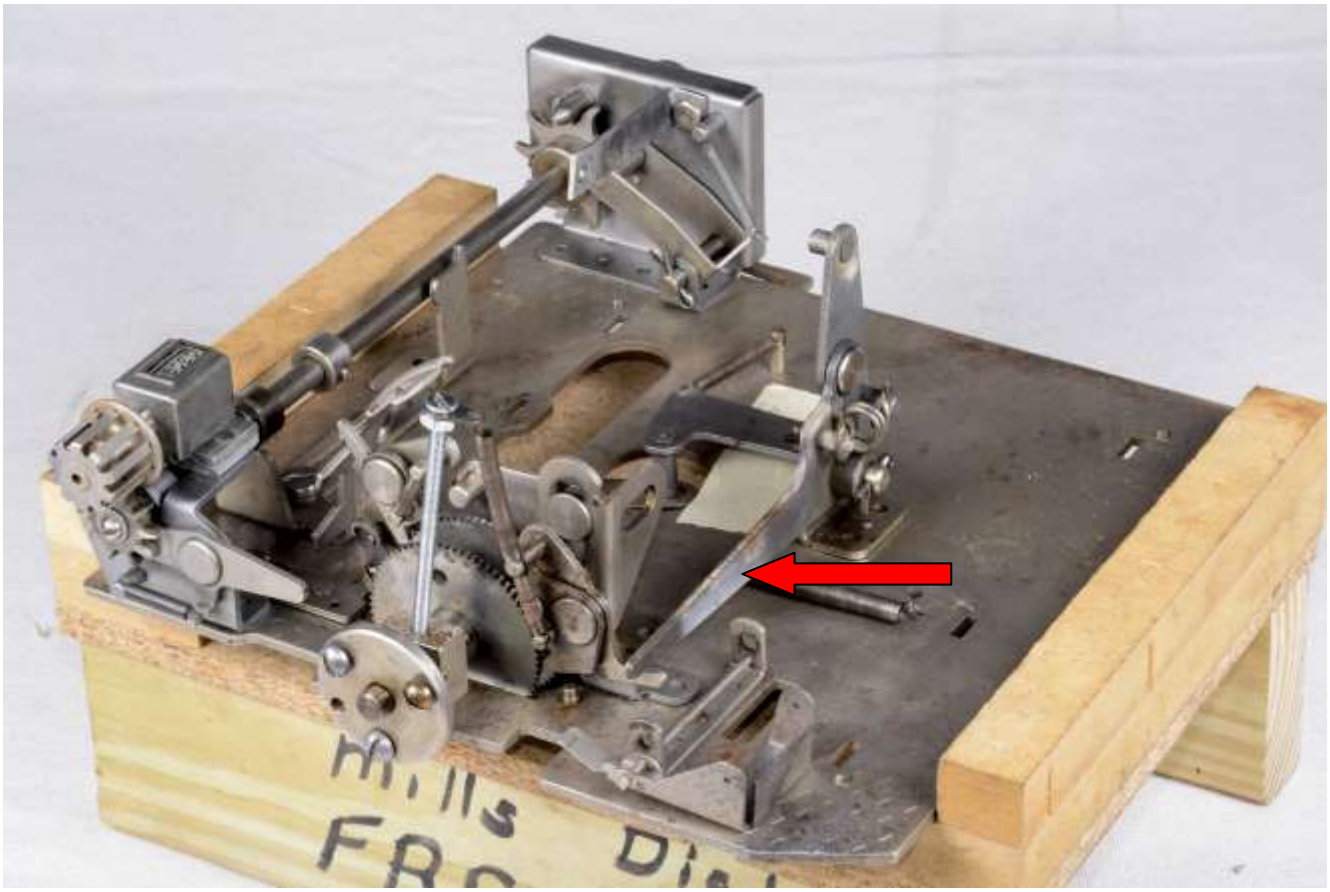

Figure 3-7

Attached to the upper side of the bed plate is a large “L” shaped hold down arm used to lock down the two ratchet gears in the dial advance block, Figure 3-7.

The advance block hold lever does two things. It works with the front ratchet pawl and holds the credit advance block ratchet wheels in place while the payout step cam on the back ratchet wheel is reset during the windup cycle and, if there are any credits earned, it again works with the front ratchet pawl and removes one credit per play.

The advance block hold lever is attached to the bed plate with one screw under the bed plate.

Front Ratchet Pawl

The front ratchet pawl, Figure 3-8, works with the advance block hold lever and holds the credit advance block ratchet gears in place while the payout step gear is reset during the windup cycle. If there are any credits earned, it works with the advance block hold lever and removes one credit per play.

There is one spring that is attached to the pawl that needs to be released from the back side of the numbers disc pointer (not shown). **NOTE**: In Figure 3-8, I have that spring attached to a 3' machine screw that's temporarily stuck in a hole in the front credit advance block, since the pointer is not there.
There is one screw, under the bed plate, that holds the front pawl in place.

Figure 3-8

Rear Ratchet Pawls

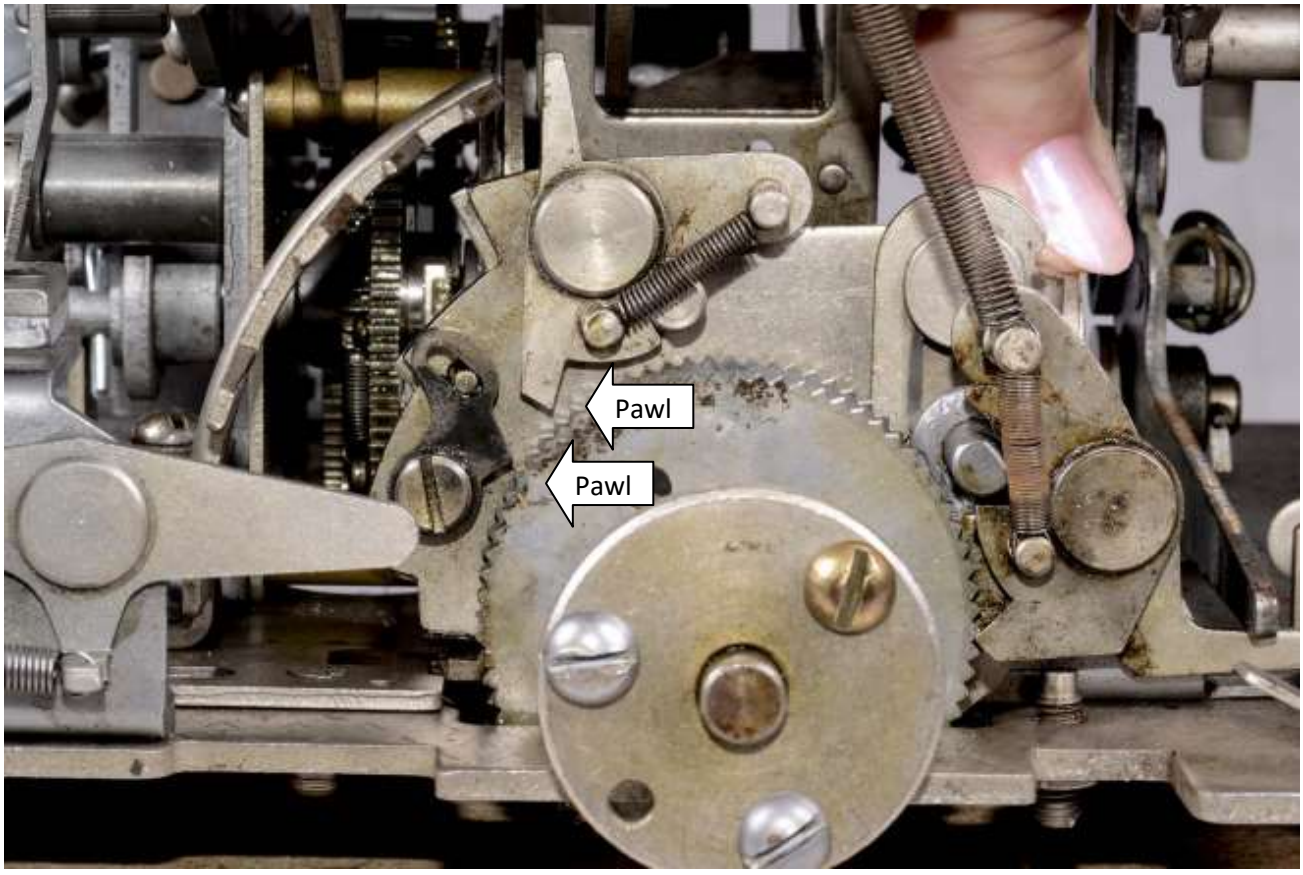

Figure 3-9

The rear ratchet pawls are used to hold the two ratchet gears in place after play. When released, they allow credits to be removed.

Payout Step Gear

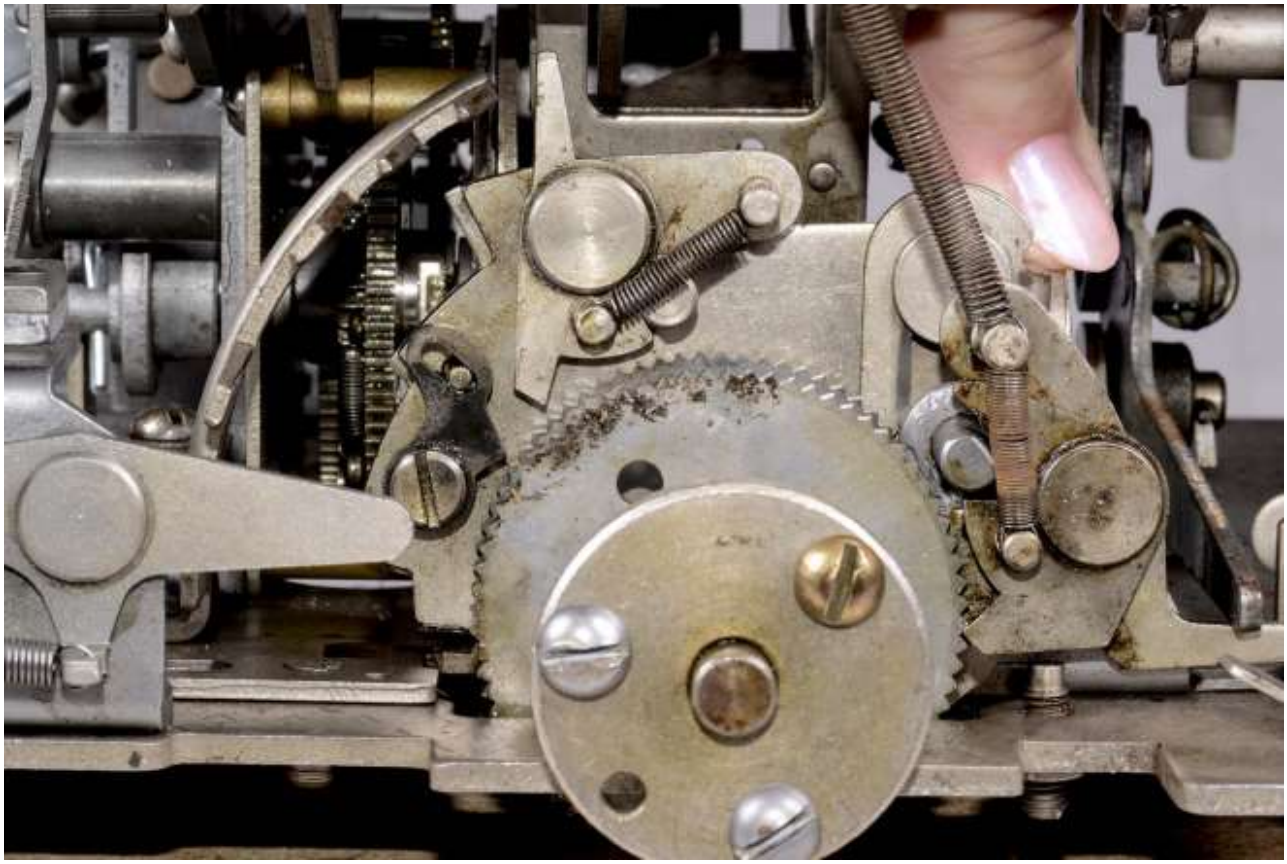

Figure 3-10

The payout step gear is used to advance the gear wheel the proper number of credits on a payout. Shown in Figure 3-10, the payout step gear is in the cocked position waiting for the payout to be determined. Once determined, it will rotate down to the proper step and turn the number disc the proper number of credits.

Sliding Reset Lever

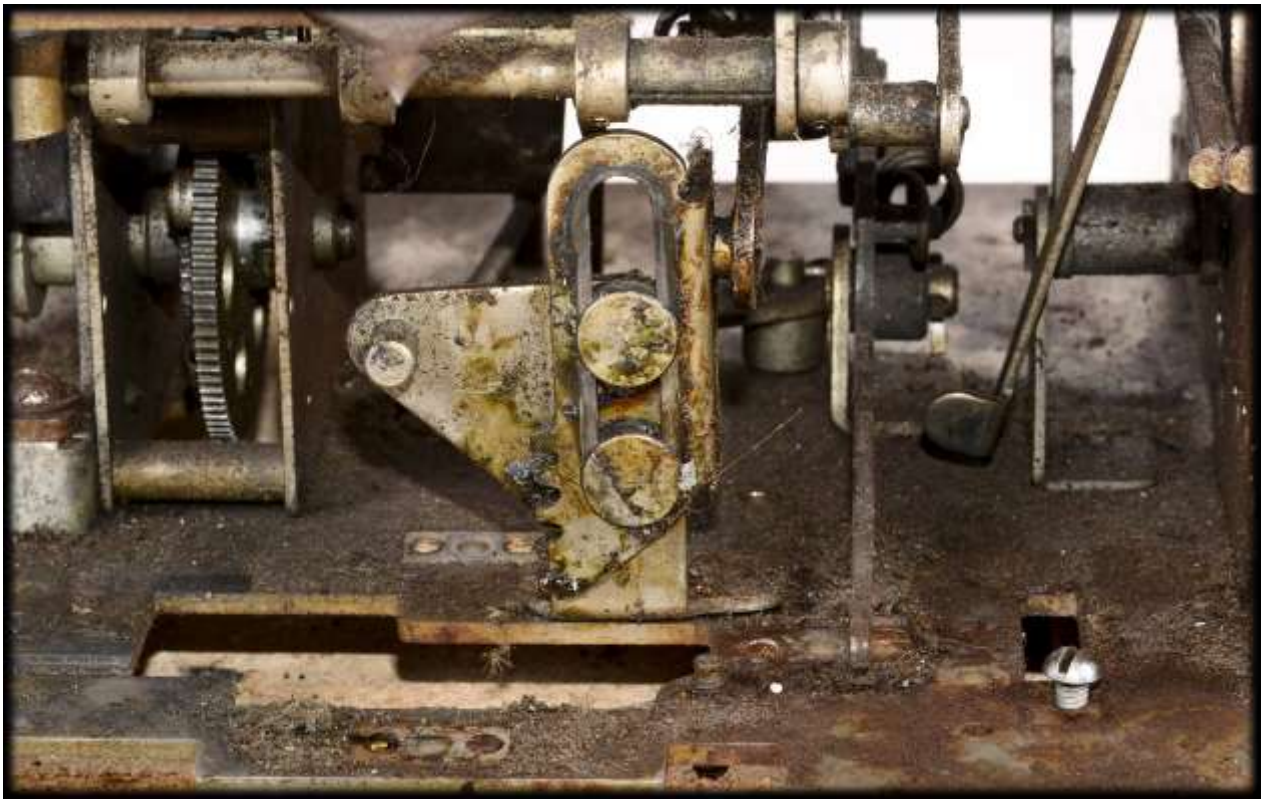

Figure 3-11

The sliding reset lever is used to reset the payout step gear during the windup cycle, Figure 3-11. In the release cycle, with the help of a strong spring, it also pulls the payout step gear down to its final resting place which depends on if there was a payout or not. The sliding reset lever is attached to the bed plate with one screw, underneath the bed plate.

Co**in Head and Freeplay Linkage**

The DIAL coin head has a couple of extra parts, Figure 3-12. There is the upper freeplay lever and the freeplay linkage wire. The freeplay linkage wire connects the upper freeplay lever with the lower freeplay lever on the bed plate. Next to the lower freeplay lever, on the bed plate, is the credit detection finger. There is some linkage on the inside of the right wall (not shown) going from the coin head down to the credit detection finger on the base plate.

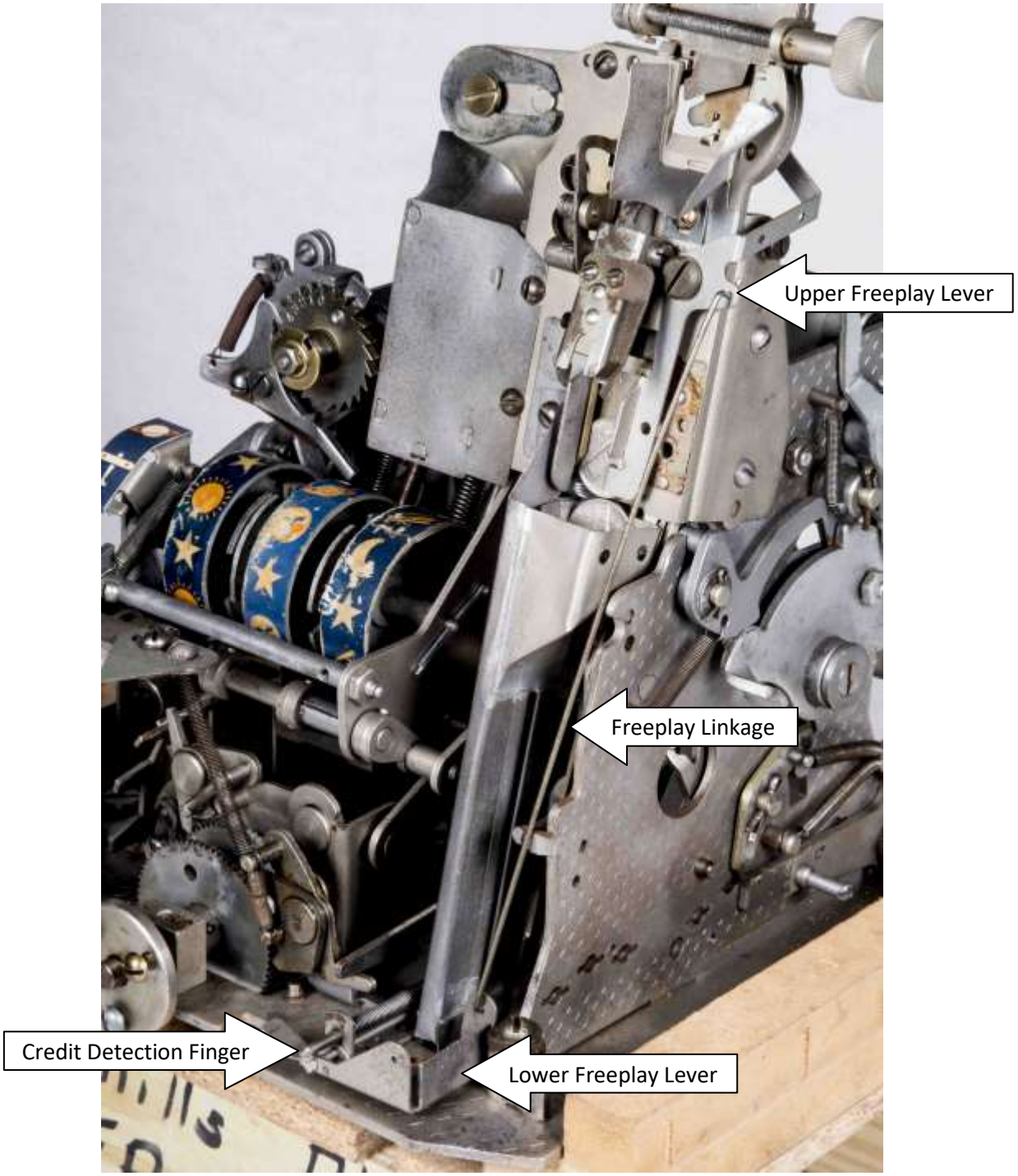

Figure 3-12

Credit Detection Finger

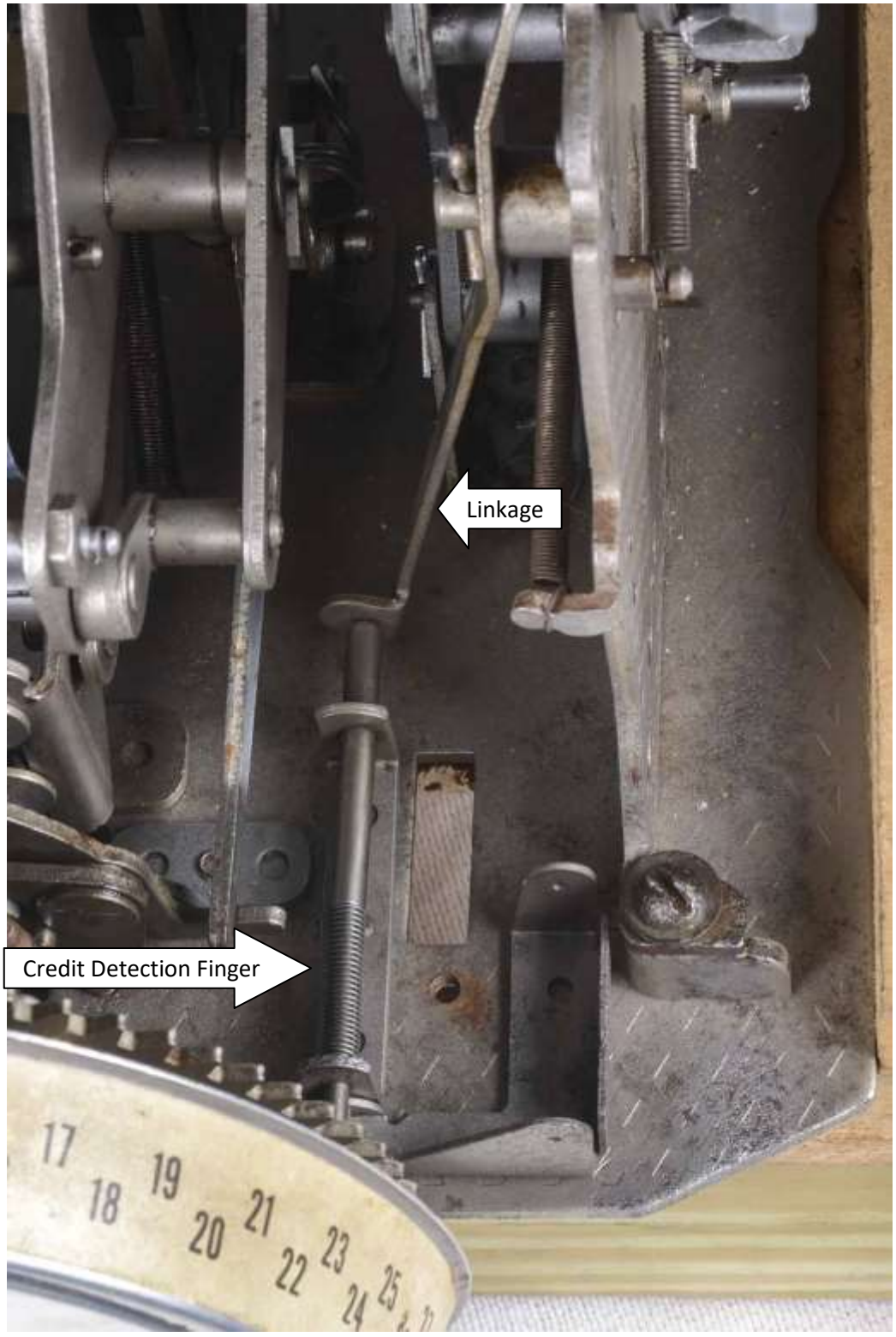

Figure 3-13

The credit detection finger, Figure3-13, is used to determine if there are any credits on account. This information is sent, via linkage, up to the coin head. If there are any credits, they act the same as inserting a coin in the coin head.

Jackpot Counter Assembly

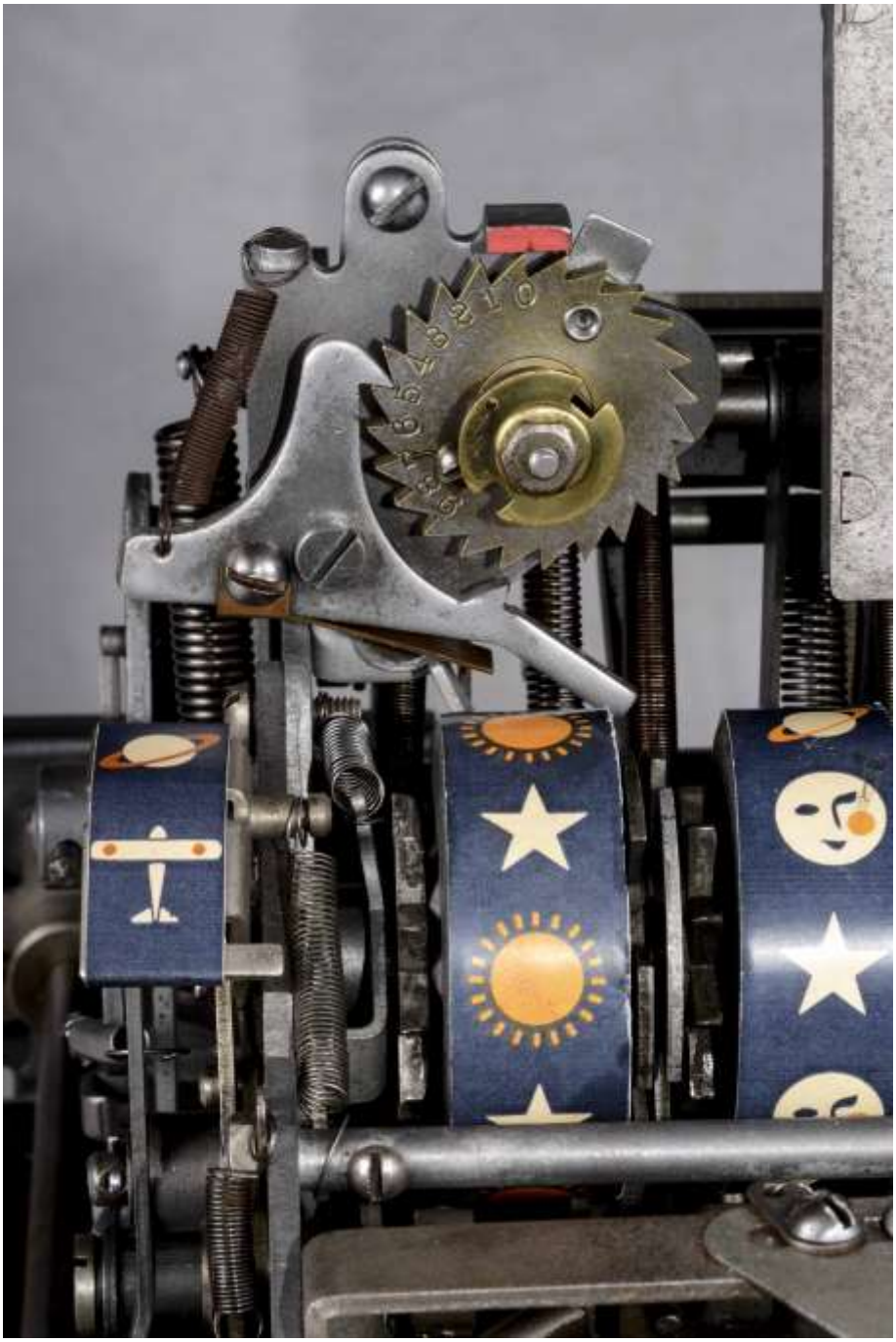

Figure 3-14

The jackpot counter assembly, Figure3-14, is used to count the number of times the jackpot has been hit. When the jackpot sensing lever is able to travel all the way up into the three reels, the flag, in the small window to the left of the reels window, changes from an aircraft to a planet and the jackpot counter assembly counts one tick. The jackpot counter assembly is numbered 1 thru 9, additional ticks 11 thru 20 are not numbered. Once the jackpot counter assembly reaches tick 20, it will have to be manually reset back to zero. You read which number the jackpot counter assembly is on at the very top. There is a very small notch in that folded tab at the 12 o'clock position.

Chapter 4
Theory of Operation

Introduction

In this chapter, I want to describe the unique DIAL functions during play. For a more detailed description of the different cycles of play that are common to the Q.T. and the DIAL, please refer back to "the book".

Out-of-Cabinet Handle

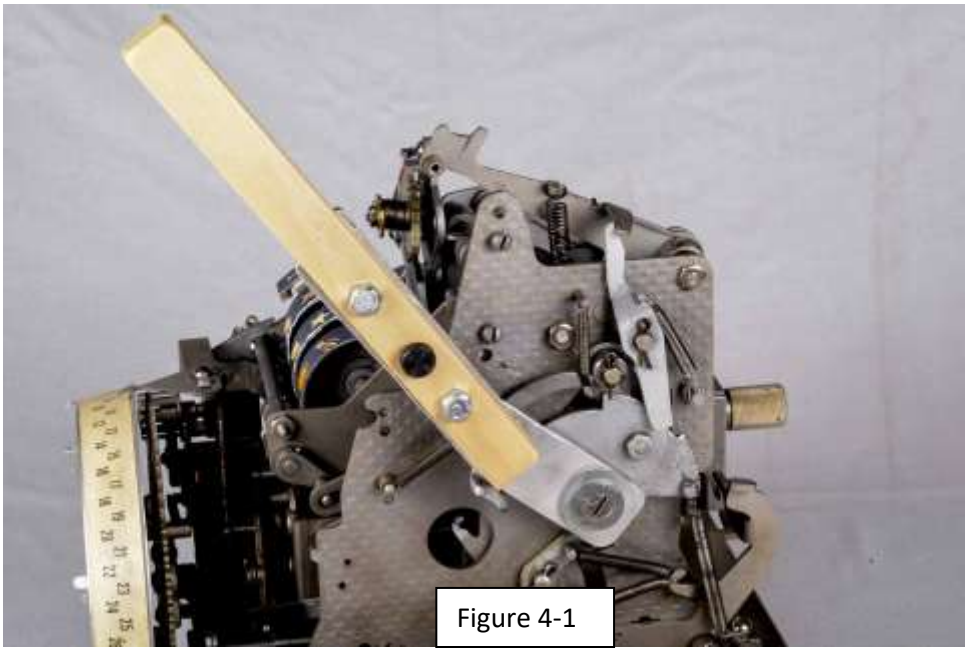

Figure 4-1

Instead of using a screw driver to assist in the cycling of the mech outside the cabinet, as seen in "the book", I created an out-of-cabinet handle to cycle the mech, Figure 4-1. The handle is made out of aluminum with a wood grip. The wood of the handle is attached to the aluminum with two flat head screws so that nothing sticks out on the mech side of the handle. The handle has a 13/16" hole at one end that is slightly larger than the hub on the operating lever. To attach the handle, I remove the flat head screw and retaining washer from the operating lever and place the 13/16" hole in my handle over the hub. I then added a larger washer to prevent my handle from slipping off and then put the original retaining washer and flat head screw back in their place. Notice the black knurled knob between the two nuts on the handle? That is where I keep that larger washer when I'm not using the handle. That knurled knob screws into a wood insert nut.

One nice thing about the DIAL machine is that there is enough room inside the cabinet to store this handle, assuming you don't make the wood handle too long. I keep the handle stored in the cabinet to the right of the cash box. Figure 4-2 shows the dimensions of the aluminum portion of the handle.

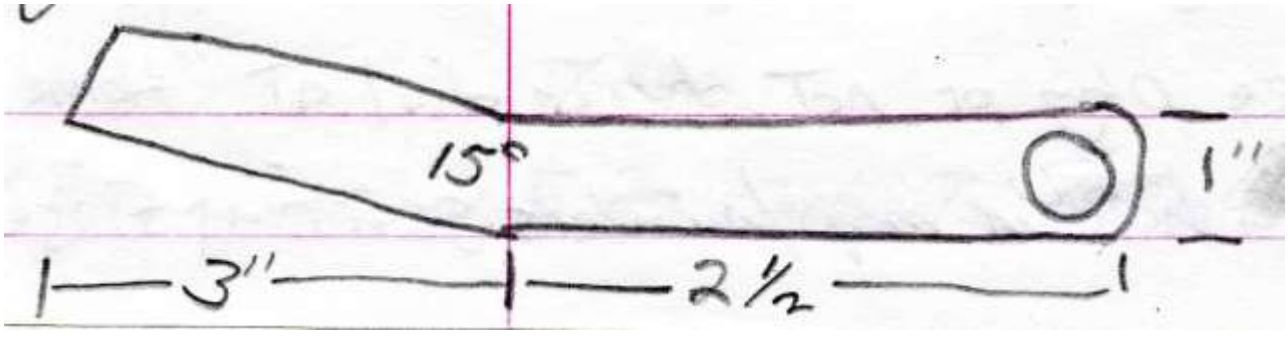

Figure 4-2

The DIAL Theory of Operation

At the beginning of a cycle of play, the same time the coin head is checking to see if a coin is in position, there is linkage going down to the credit detection finger, on the bed plate, that checks to see if there are any credits on account, Figure 4-3. If the credit detection finger's movement is blocked by the gear ring, then credits are available. The only time the gear ring does NOT block this movement is when there are no credits. That's when that round tab on the front of the gear ring is at the "home" or "three o'clock", position. The credit detection finger is allowed to go into the back side of that round tab. Also, as soon as the gear ring moves off "home" position, meaning credits have been won, there is a short post on the back of the gear ring that moves up and releases the coin head freeplay linkage. This linkage is gravity fed and is used to prevent a coin from being played. A small finger will protrude through the coin head, just below the coin entry, forcing all coins put into the coin head to pass through. So, if there are no credits then the coin head checks for a coin. If there are credits, then the credit detection finger, through its linkage, tells the coin head to allow the cycle to begin as if there was a coin there.

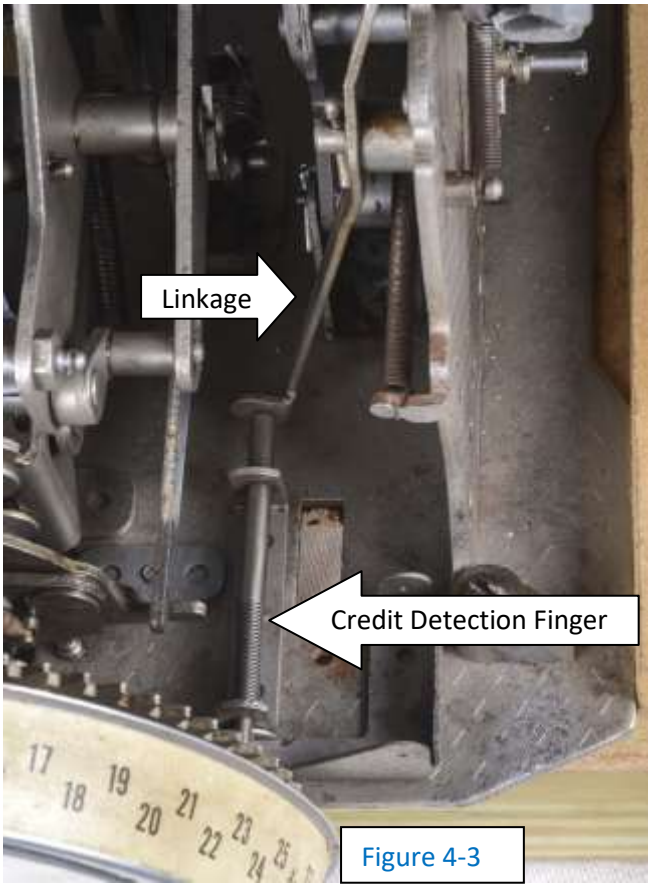

Figure 4-3


Figure 4-4

Also, at the beginning of the cycle, the advance block hold lever, Figure 4-4, is pushed down against a finger sticking out from the pawl next to the credit advance block, front gear, which causes the pawl to hold the gear in place. As we get deeper in the windup cycle, the advance block hold lever pushes a little harder until the pawl is resting on top of a set screw rising up from the bed plate. This is when one credit is removed, if any are there. If your DIAL either isn't stepping back one credit or removing two credits for each non-win, then perhaps this set-screw needs adjusting. There is a lock nut for the set-screw under the bed plate.

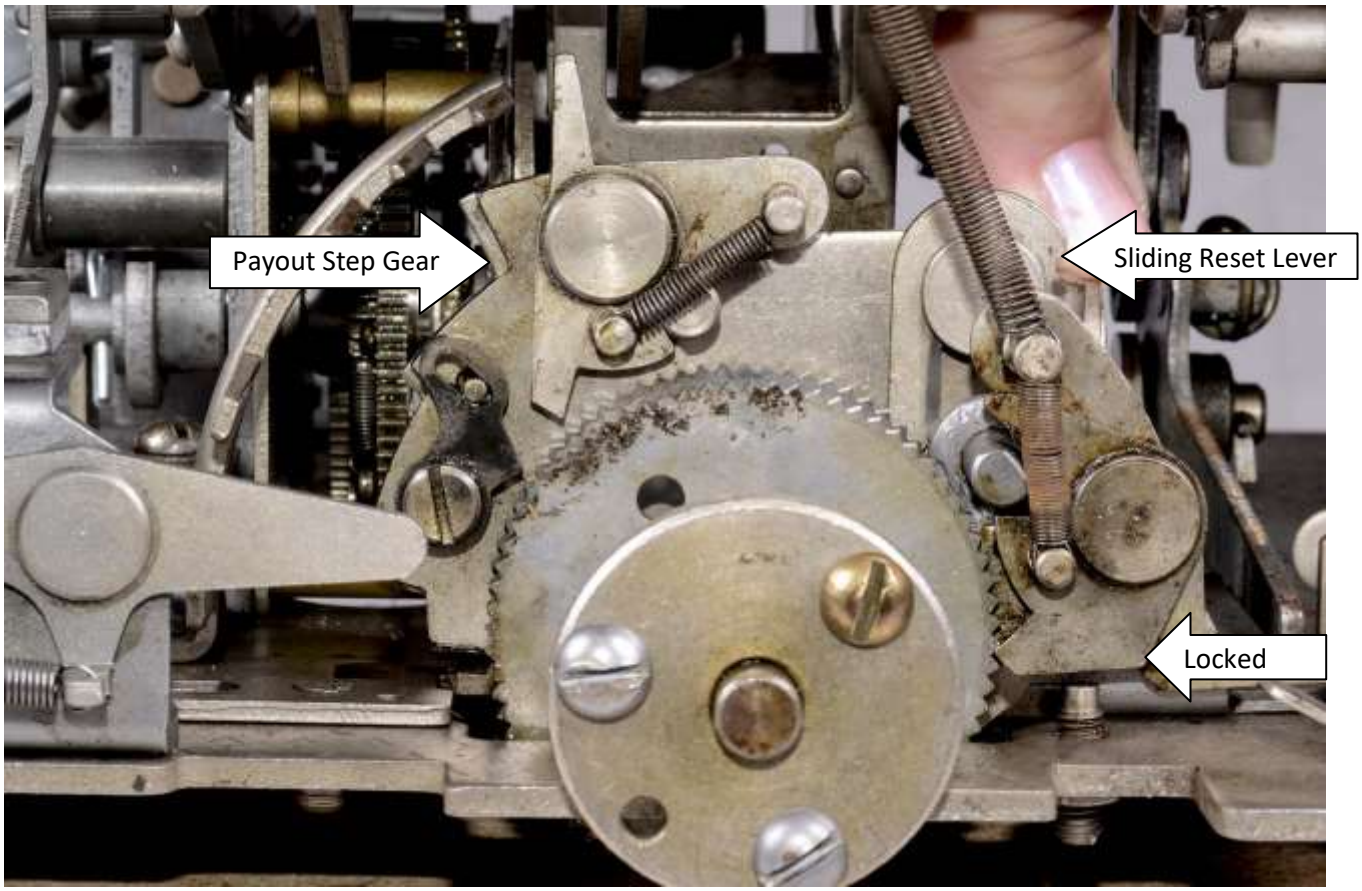

Figure 4-5

With both gears in the credit advance block locked in place, Figure 4-5, the sliding reset lever is pushed down causing the payout step gear to rise up above the bed plate. It will remain in this position, waiting for the payout to be determined. Once the payout is determined the same sliding reset lever is allowed to rise up, with the help of a strong spring, pulling the payout step gear down to the proper payout stop. If there is a payout, then the payout step gear will advance the gear ring the proper amount of credits.

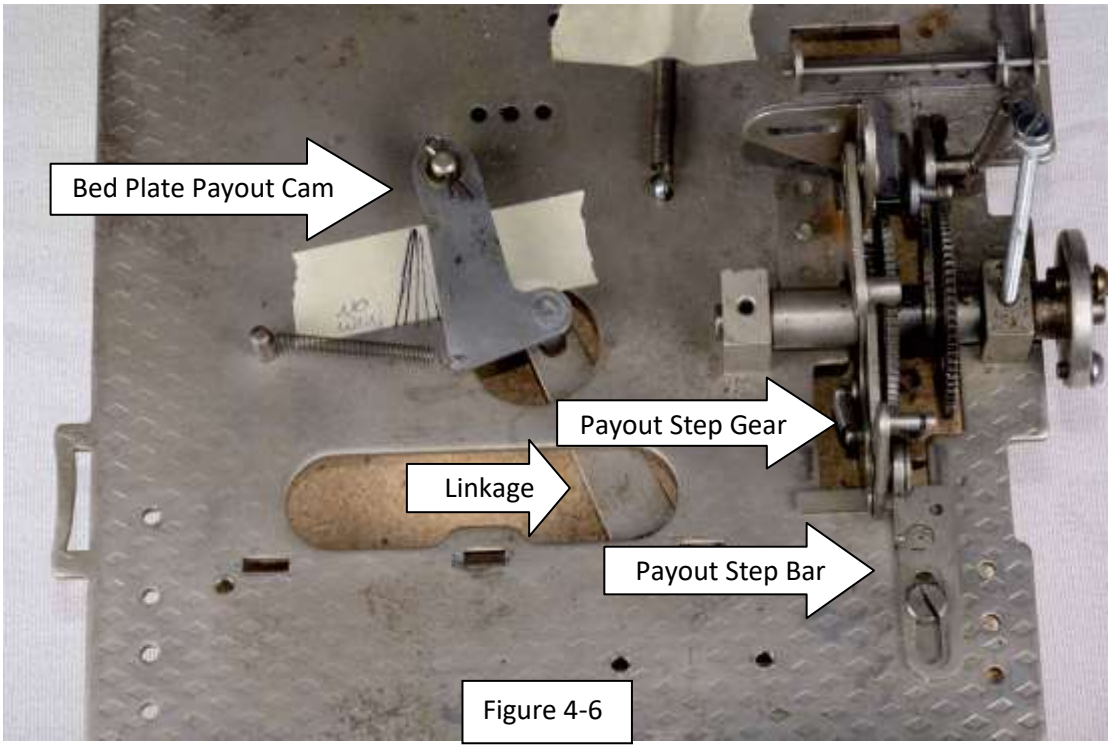

Figure 4-6

The number of credits awarded is determined by the notches in each of the three reels and the payout sensing lever. Each winning combination, and also a no-win combination, will determine the resting position of the lower extension on the payout sensing lever (described in "the book"). The different resting positions, between each payout (0, 2, 4, 8, and 12), is only about 1/8" distance between each one. The payout sensing lever's lower extension is in contact with the DIAL's bed plate payout cam, Figure 4-6. The resting position of the lower extension is transferred, via the bed plate payout cam, to a linkage arm under the bed plate, to the payout stop bar above the bed plate and next to the payout step gear. The distance the payout stop bar is from the payout step gear determines how far down the payout step gear is allowed to travel down when released. The closer the payout step bar is, the less travel for the payout step gear and the less the payout. The further away, the greater the payout.

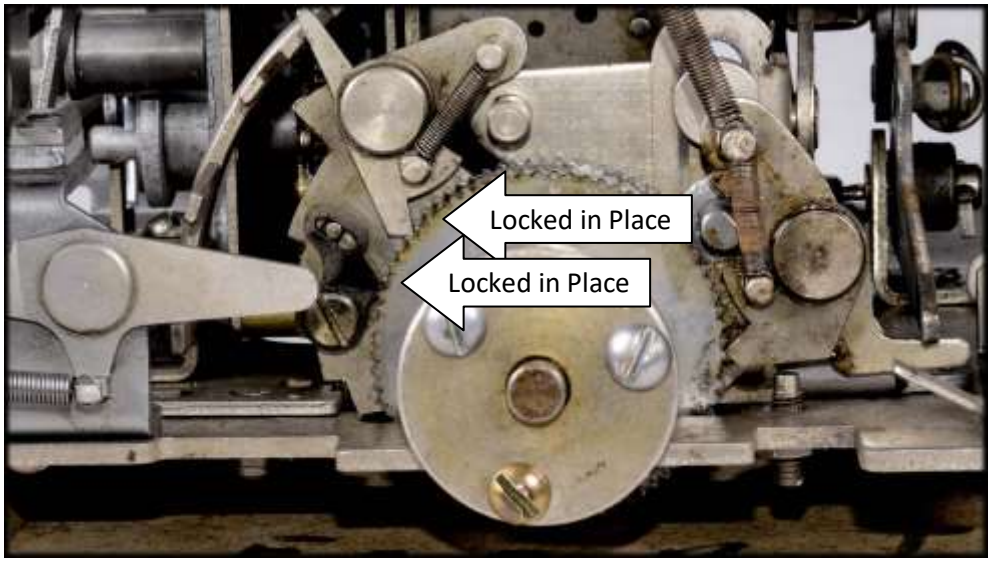

Figure 4-7

Figure 4-8

Payout wheel showing the five payout positions (0, 2, 4, 8, 12) on the wheel, Figure 4-8

At the end of a cycle, both of the credit advance block gears should be locked in place by the two pawls on the rear credit advance block gear preventing the gear ring from moving, Figure 4-7.

Jackpot

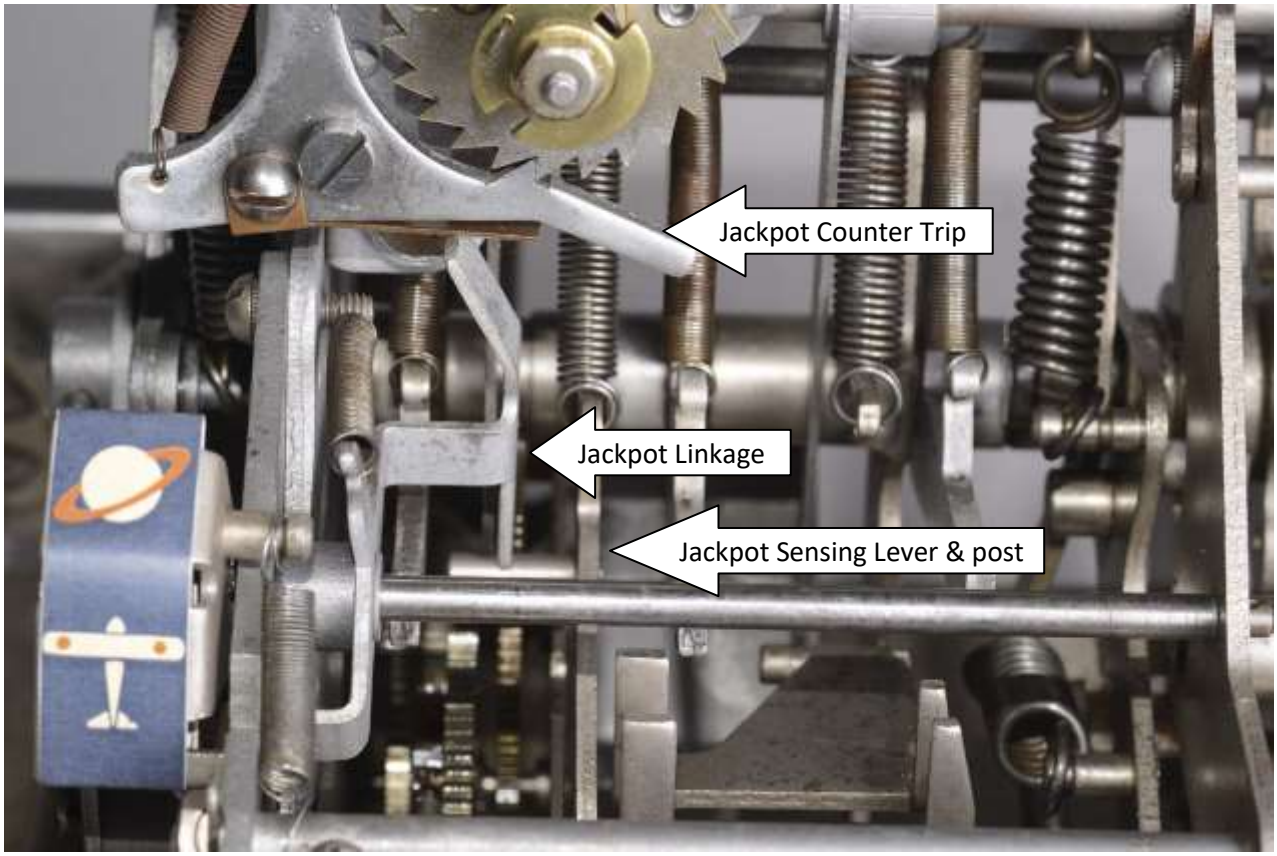

Figure 4-9

Hitting the jackpot does two things. It counts one tick on the jackpot counter in the top of Figure 4-9 and it changes the flag in the small window to the left of the three reels window from an airplane, normal operating mode, to the planet. It doesn't add any more credits to your total shown in the credits window.

The jackpot is awarded when the jackpot sensing lever is allowed to go all the way into the jackpot notches on the three reels. When this is done, the jackpot sensing lever rises high enough for the post, sticking out to the left on the lever, to push up against the jackpot linkage that also pushes up on the jackpot counter trip. The jackpot linkage also trips the jackpot flag causing the planet to drop down into the window replacing the airplane. You can continue playing the machine after hitting a jackpot. The jackpot window will continue showing the planet. The only way to change the flag back to the airplane is to use the credit removal knob, at the back of the machine to reset the jackpot flag and clear all credits.

Credit Removal

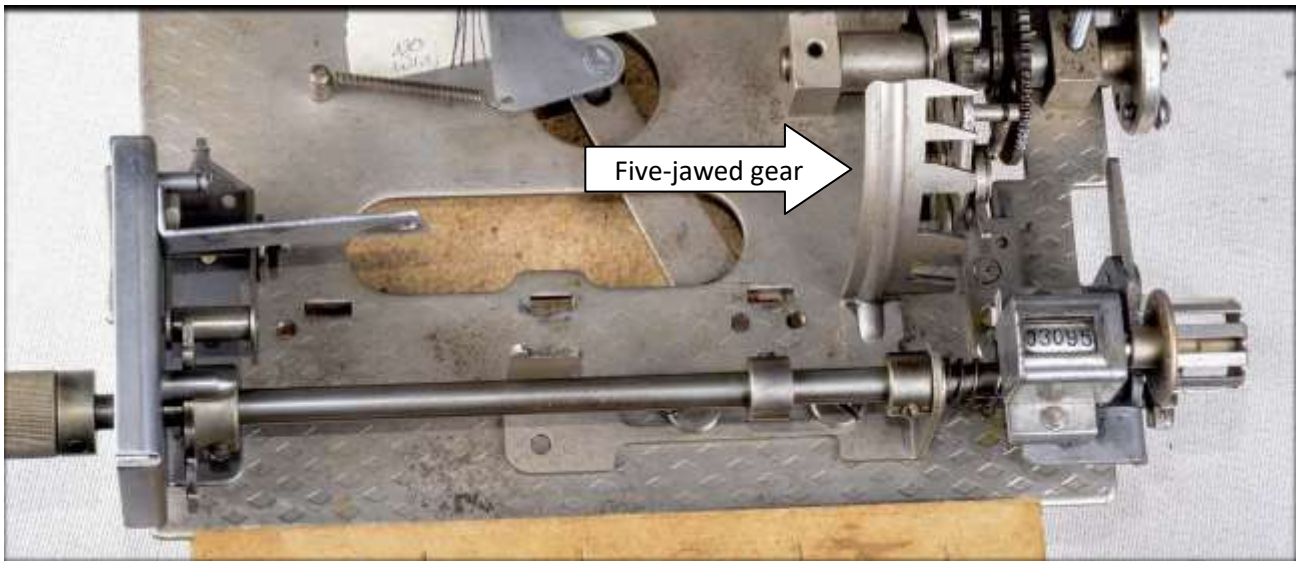

Figure 4-10

The Credit clearing linkage is located just outside of the left frame. This linkage is used to reset the jackpot flag and remove unused credits.

When the credit removal knob, protruding from the back of the cabinet, is pressed in, it resets the jackpot flag. I also causes a large quarter circle five-jawed gear to move forward and disengage the two ratchets on the rear gear of the credit advance block, Figure 4-10. At the front end of the credit removal rod is a small star wheel gear that engages the gear ring, Figure 4-12. The credit removal rod is then locked in the “in” position. When the knob is turned, it starts the credit removal process. It causes the gear ring to slowly return back to the home, no credits, position. As credits are removed, they are counted on the counter that keeps a running total of credits removed. When there are no more credits to remove, a post on the back of the gear ring will make contact with a lever next to the star wheel that will disengage the credit clearing linkage releasing the rod.

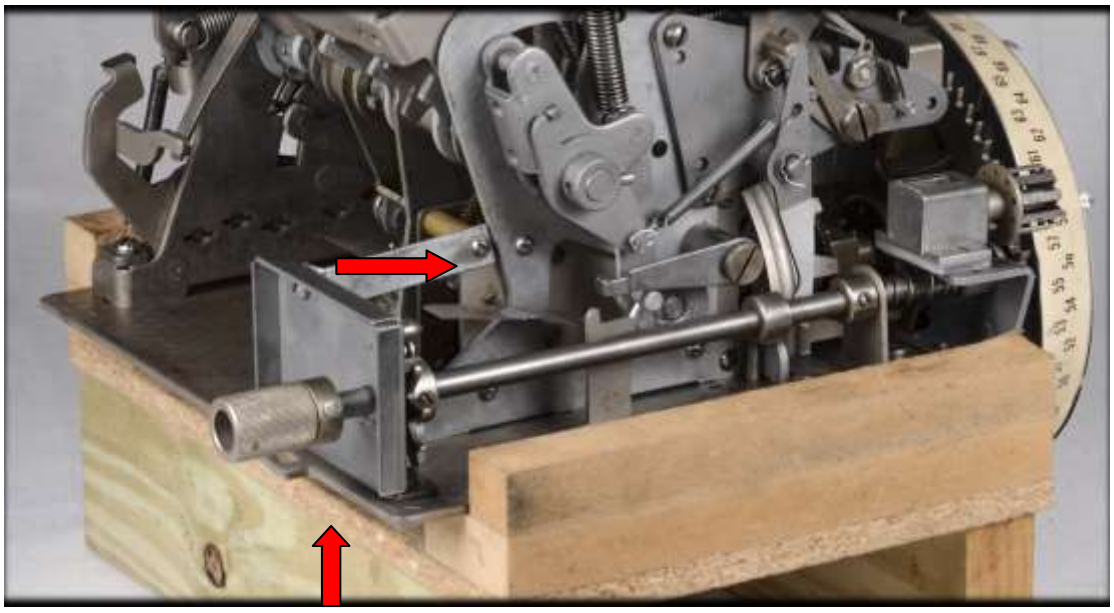

Figure 4-11

To remove this linkage, remove the screw attaching the rear brace connected to the clock frame. Remove the front and rear screws, under the bed plate, attaching the linkage to the bed plate (arrows). With the linkage loose and maneuverable, remove the two shoulder screws attaching the large quarter circle five-jawed gear to the bed plate, Figure 4-12.

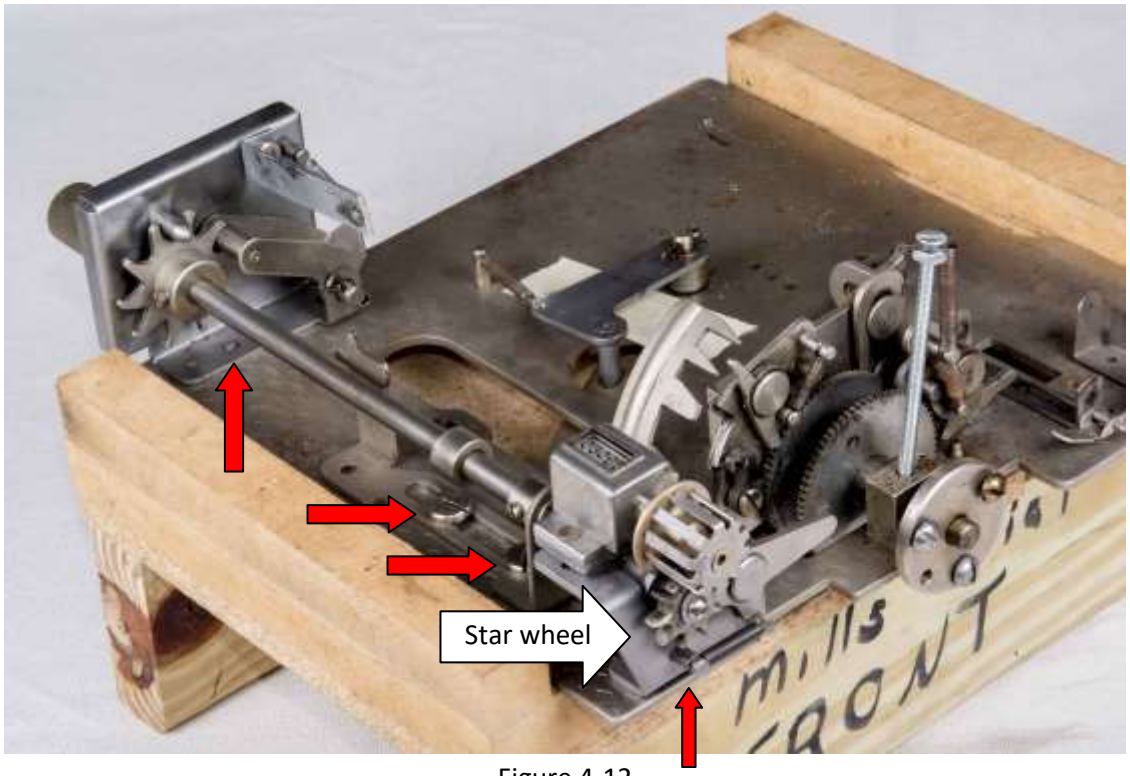

Figure 4-12

Chapter 5
Workarounds and Troubleshooting

This Chapter is a work-in-progress. I would like to identify common problems collectors have come across specifically for the Mills DIAL. I would appreciate your input for this chapter. If you have anything you would like to add that is specific for the Mills DIAL, please send me your information. Again, my email address is on the inside front cover.

Original Mills Locks Are Missing

It seems to be very common to have the locks missing from this machine. To add to the problem, these locks aren't your standard size cam lock and are not available in this size. They are a bit larger than a standard cam lock. The same size lock is used in the Mills Vest Pocket, but it's configuration is slightly different. I don't think you can put a Vest Pocket lock on a DIAL without modifications. Also, a Mills front jackpot lock is the same diameter but a completely different design and probably won't work.

About your only option, if you can't find an original DIAL lock, is to use a standard size cam lock with a small hand-made shim to keep it centered in the oversized hole. You will also need to add a collar ring to the front of the lock to prevent the head of the standard size lock from passing through the hole.

Out-of-Cabinet Handle

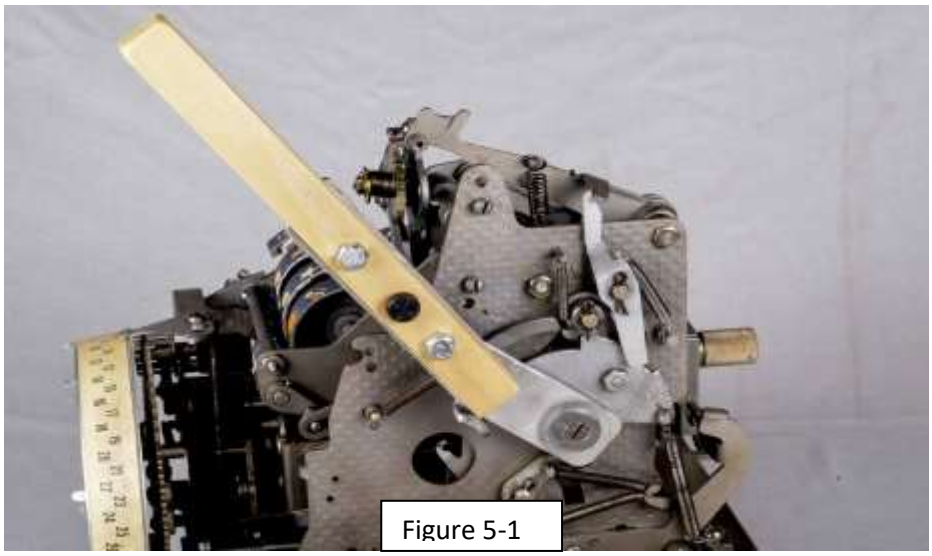

Figure 5-1

Mentioned in Chapter 4, I'm showing it here as well. Instead of using a screw driver to assist in the cycling of the mech outside the cabinet, as seen in "the book", I created an out-of-cabinet handle to cycle the mech, Figure 5-2. The handle is made out of aluminum with a wood grip. The wood of the handle is attached to the aluminum with two flat head screws so that nothing sticks out on the mech side of the handle. The handle has a 13/16" hole at one end that is slightly larger than the hub on the operating lever. To attach the handle, I remove the flat head screw and retaining washer from the operating lever and place the 13/16" hole in my handle over the hub. I then added a larger washer to prevent my handle from slipping off and then put the original retaining washer and flat head screw back in their place. Notice the black knurled knob between the two nuts on the handle? That is where I keep that larger washer when I'm not using the handle. That knurled knob screws into a wood insert nut.

One nice thing about the DIAL machine is that there is enough room inside the cabinet to store this handle, assuming you don't make the wood handle too long. I keep the handle stored in the cabinet to the right of the cash box. Figure 5-3 shows the dimensions of the aluminum portion of the handle.

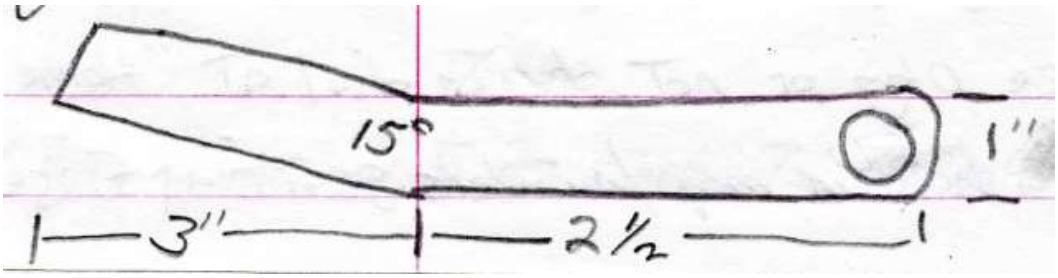

Figure 5-2

Platform to Hold the Mechanism While Out of the Cabinet

Figure 5-3

When you pull the mech out of the cabinet, you have to have a raised platform that is high enough to prevent the numbers disc from touching the workbench top. I made one from scrap 2x4s, ½" particle board, and ¾" MDF strips. As you can see, I cut a slot to accommodate the coin chute that sticks out below the base of the mech. When a coin is used to cycle the mech, it falls between the front and rear 2x4s. The mech sits on the first step above the particle board. Take a look at the pictures in the supplement to see the mech sitting on the platform.

Credit Advance Block Awarding Too Many Credits

It has been reported that a few DIALs are awarding more credits than what was won. After talking to the person that reported this, we think it may be a combination of worn down teeth on the credit advance block or perhaps too strong or too weak of a spring somewhere in the payout process.

Numbers Disc Folding Tabs

This is a problem that I've seen that I haven't figured out how to fix. The numbers disc is made of aluminum. The eight tabs punched out and used to hold the map plate in place were not designed to be folded very often and will easily break off. If enough tabs break off, you won't be able to effectively hold the map plate in place. The obvious solution would be to get more numbers disc produced, however, I would think that would be too expensive. I'm looking for an alternative way to secure the map plate to the numbers disc, assuming all of the tabs have broken off. I welcome your suggestions.

Mechanism Jamming During Windup Cycle

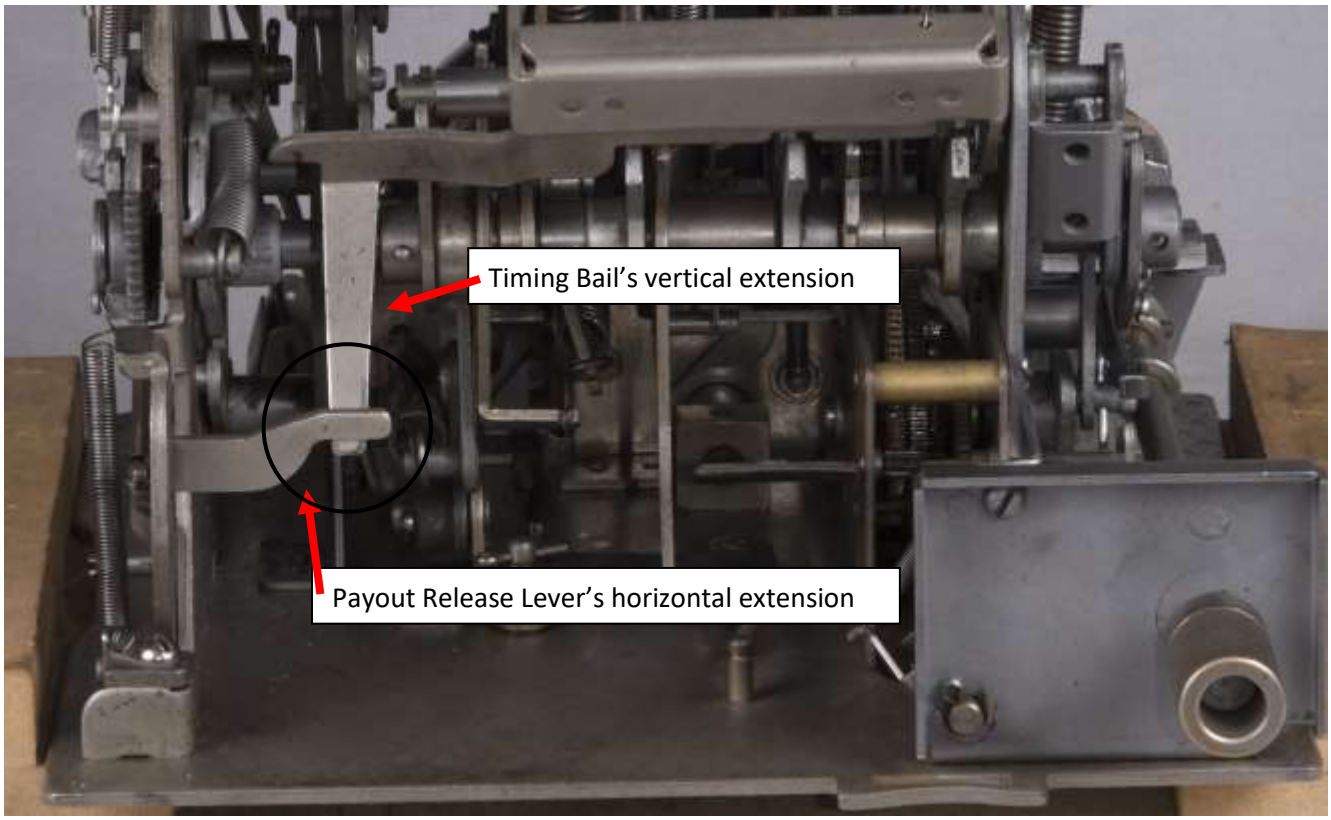

Figure 5-4

A couple of times, my DIAL has jammed after I pull the handle. Somehow, the Timing Bail's vertical extension has gotten behind the Payout Release Lever's horizontal extension. The picture above shows the correct positions for both. [Type a quote from the document or the summary of an interesting point. You can position the text box anywhere in the document. Use the Drawing Tools tab to change the formatting of the pull quote text box.]