

49 THINGS YOU
NEED TO KNOW
ABOUT YOUR
PINBALL
MACHINE

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MEMBER
LAS VEGAS PINBALL COLLECTORS CLUB

WARNING!!!

LEAD

METAL OF DEATH!

SOLDERING WIRES ON PINBALLS IS SO EASY! YOU DO IT ALL THE TIME!!! BUT MEDICAL EVIDENCE IS POINTING MORE AND MORE TO THE DANGERS OF INGESTED & INHALED LEAD! DON'T TAKE CHANCES! THE GOVERNMENT HAS OUTLAWED PAINT THAT HAS A LEAD CONTENT OF $3/10^{th}$ OF 1 PERCENT LEAD!!! ELECTRONIC SOLDER IS 60% LEAD! HERE SOME SIMPLE TIPS!!!

- WEAR GLOVES! - FLEXIBLE COTTON GLOVES OR RUBBER SURGICAL GLOVES ARE IN ORDER IF YOU'RE DOING A LOT OF JOINTS!
- VENTILATION! IN FACTORIES, SOLDERING LINES HAVE TUBES COMING DOWN TO EACH STATION! WORK OUTSIDE, OPEN A WINDOW, OR SET UP A FAN! THE SMELL OF BURNING FLUX SHOULD SERVE AS A WARNING YOU ARE TOO CLOSED IN!
- WASH YOUR HANDS! SOUNDS SIMPLE, BUT IT CAN GREATLY REDUCE YOUR RISK! WHEN DONE WORKING, CLEAN UP!
- DON'T TOUCH YOUR FACE OR EYES! DON'T PICK YOUR NOSE AND EAT IT!
- DON'T EAT OR SMOKE WHILE SOLDERING! LEAD IS SOFT AND FLAKES VERY EASILY! AIRBORNE LEAD WILL FALL INTO OPEN CONTAINERS OF SOFT DRINKS!

DON'T BE A DEAD DORK! WISE UP AND GET WITH THE PLAN! THE CLUE BUS IS COMING INTO YOUR STOP! BE ON IT!

1

DON'T USE METAL TOOLS ON SOLID STATE GAMES WITH THE POWER ON!

IF YOU LEARN NOTHING ELSE FROM THIS SEMINAR, THIS IS THE MOST IMPORTANT! 75% OF THE BOARDS I REPAIR HAVE BEEN BLOWN UP THIS WAY! THE COILS RUN AT NOMINAL VOLTAGES AS HIGH AS 70 V.D.C.!!! ONE CARELESS SLIP OF A SCREW DRIVER SENDS THIS VOLTAGE UP A SWITCH OR LAMP LINE RIGHT TO THE CONTROL BOARD! I'VE SEEN THE TOPS BLOWN RIGHT OFF CHIPS! IT TAKE ONLY SECONDS TO FLIP THE ON-OFF SWITCH, SAVING HOURS OF NEEDLESS BOARD REPAIRS!

2

DON'T IGNORE YOUR BALL!

A MISSING SHOOTER TIP WILL RUIN A BALL! ALWAYS REPLACE!

1 1/16" GRADE 35 STEEL BEARING ANY BIG CITY BEARING SUPPLY - UNPER A BUCK!

THE BALL IS HALF THE GAME! A SMOOTH WAXED PLAYFIELD WITH A PITTED GRAY BALL IS MUCH SLOWER! AN UNPOLISHED BALL WILL ALSO CAUSE PLAYFIELD "PITS"! LOOK AT YOUR BALLS OFTEN! FONDLE THEM! IF THEY ARE RUSTED OR PITTED, JUST THROW THEM OUT! IF THEY ARE JUST "GRAY" POLISH THEM! GET A HIGH SPEED BENCH GRINDER! A GEM SHOP WILL HAVE CLOTH WHEELS! I LIKE 1" SURFACE 6" DIA. WITH 1/8" HOLE FOR MY 9600 R.P.M. 1/2 HORSE MILLWAKEE! GEM STORES ALSO HAVE STAINLESS STEEL OR CHROME JEWELERS ROUGE! IT'S THE GREEN STUFF! AVOID THE BIG BRICK, GET THE HANDY TUBE! DOPE UP YOUR CLOTH WHEEL OFTEN, DON'T PRESS INTO THE WHEEL, LET THE ROUGE DO THE WORK! A BETTER THAN NEW MIRROR SURFACE TAKE ONLY A COUPLE MIN.'S! CAUTION! DON'T BE A BLIND SCHMULK WITH BURNED LUNGS & FINGERS! WEAR SAFTY GLASSES AND A DUST MASK! CLOTH OR WELDERS GLOVES! KEEP YOUR FINGERS SAFE FROM THE HEAT!

3 SPRAY CONTACT CLEANER IS EVIL!



I DON'T CARE WHAT YOUR UNCLE TOLD YOU! I DON'T CARE THAT THE LABEL SAYS "SAFE-LEAVES NO RESIDUE"! THEY ARE FALSE! THIS IS A LAZYFOOLS FIX! IT'S A CHEMICAL SOLUTION TO A MECHANICAL PROBLEM! 95% OF THE DIRT CAN BE REMOVED BY WIPING WITH A SOFT CLOTH! THIS IS ALL YOU SHOULD DO TO A DIGITAL GAMES GOLD PLATED HEADS! ELECTRO-MECHANICAL GAMES AND ALL FLIPPER SWITCHES ARE MADE OF SILVER OR A HARD ALLOY! THESE SHOULD BE FILED FLAT AND SMOOTH! WHILE FILEING, IF THE HEAD IS LOOSE, REPLACE THE WHOLE BLADE! AFTER BOTH CONTACTS ARE CLEAN AND/OR FILED, ADJUST FOR SELF CLEANING BY HAVING THE 2 OVERWIPE ON CONTACT! THIS LACK OF OVERWIPING IS WHY THE CONTACTS GOT DIRTY IN THE FIRST PLACE! A PROPERLY ADJUSTED CONTACT SHOULD NEVER GET DIRTY! ALSO, BAKELITE SPACERS DRY OUT, LEAVING LOOSE SWITCH STACKS! TIGHTEN BOTH SCREWS BEFORE ADJUSTING! FORWARD SCREWS 1st!

4 DO NOT USE TAPE TO BUNDLE LEGS TOGETHER!

IT PULLS THE PAINT OR CHROME OFF! OLD RUBBER RINGS ARE O.K. FOR SHORT TERM STORAGE! I USE SCRAP WIRE FROM OLD HARNESS! GOTTLIEB LEGS LOOK LIKE NEW WITH "NO 7." BRAND CHROME POLISH FROM ANY AUTO STORE! RINSE WELL, TOWEL DRY! NEW FOOTIES ARE A MUST! ALL THE PARTS HOUSES HAVE EM! DAB GREASE INTO THE THREADS TO PREVENT RUST BEFORE YOU SCREW EM IN! I ALSO POLISH THE FRONT LEG BOLTS (SEE ITEM #2) TO A MIRROR FINISH! SLICK! CHECK THE LEG BOLT MOUNTING PLATES ON THE INSIDE OF THE CABINET! THEY ARE HELD IN PLACE ONLY WITH NAILS! IF THEY ARE LOOSE, REPLACE WITH SCREWS! IF THE HOLES ARE STRIPPED, DON'T MESS AROUND JUST SHIT CAN + REPLACE WITH NEW ONES!

5 DO NOT SHIP YOUR GAME WITH THE BALLS IN IT!

IT WILL BREAK DROP TARGETS, BUMPER CAPS AND WEAR A DEEP GROOVE IN THE TOP ARCH! BE A HIGH-CLASS HAULER! POP THE BALL INTO A BAG WITH THE LEG BOLTS AND STASH SECURELY IN THE CASH BOX!

6 DON'T USE WATER BASED OR ABRASIVE PLAYFIELD CLEANER!

THERE ARE SOME PINHEADS THAT ADVOCATE A ONE TIME CLEANING WITH AN ABRASIVE CLEANER! I DO NOT AND WILL NOT AGREE! ABRASIVES MAKE THE PAINT LOOK NEWER BY STRIPPING AWAY THE PROTECTIVE HARD-COAT! IT'S LIKE PISSING YOUR PANTS IN THE WINTER TO KEEP WARM! SHORT TERM, EVERYTHING IS GREAT! BUT LONG TERM, YOU LOSE! AT NO TIME SHOULD ANY WATER BASED CLEANER BE USED! IT SEEPS INTO THE WOOD AND CAUSES IT TO SWELL, PULLING THE PAINT APART (CRACKS)! IT ALSO WEAKENS THE ADHERING OF THE PAINT TO THE WOOD! ALL I HAVE EVER USED, FOR 15 YEARS, IS CREAMY CAR WAX! I LIKE PINK EXCALIBUR OR KIT-SPRINT! HANDY SQUEEZE BOTTLES, CHEEP, AVAILABE EVERYWHERE! AVOID RUNNY WAX LIKE TURTLE WAX, TOO EASY TO GET IT IN WHERE IT DOESN'T BELONG! PASTE WAX IS MORE WORK! ANY CAR WAX IS OK, AS LONG AS IT'S NOT "CAR WASH"! CARWAGA IS A PLUS! I ALSO LIKE JOHNSON PASTE WAX!

7 DONT PRY OPEN COIN DOORS!

IF YOU GET A GAME IN WITH NO KEYS, PICK IT OPEN! MOST LOCKSMITH SHOPS SELL PICK SETS! IF NOT THIS, DRILL OUT THE LOCK! A GOOD BIT GOES RIGHT UP THE MIDDLE OF MOST EXTRUDED BRASS (ACE) OR BI-METAL (FORT, TUF, GUARD) AND OUT THE OTHER END! BACK DOORS ON EM GAMES CAN BE POPPED OPEN WITH A QUICK STROKE OF A LARGE SCREWDRIWER WITHOUT MUCH DAMAGE! REACH THRU HOLE IN BOTTOM OF HEAD WITH A DIME AND UNDO SCREW!

8 BRACE SCORE REELS WHEN CLEANING!

GOTTLIEB "DECAGON" UNITS (1967-1979) HAVE A SPRING-STEEL BLADE AS A DETENT PAWL (HOLD IN ON FORWARD STROKE) THAT WILL BECOME BENT BACK AND USELESS IF YOU FORCE PLASTIC DIAL BACKWARDS DURING ROUTINE CLEANING! CLEAN WITH ONE HAND, BRACE WITH THE OTHER! THIS IS ALSO A GOOD HABIT TO GET INTO WITH DAILY, WILL, ETC DIALS, ALL OF WHICH WERE DESIGNED NOT TO BE FORCED IN THIS WAY! TO WORK FAST & TRUE, THESE UNITS HAD TO BE DESIGNED WITH TOLERANCES OF ONLY 1-2 GRAMS! BE GENTLE! I HAVE ALWAYS USED CREAMY CAR WAY ON SCORE DIALS, AND NEVER HAD INK COME OFF! WATER WILL! CHICAGO COIN DIALS WITH TRANSLUCENT PLASTIC REELS WILL BE WIPED OFF WITH CAR WAY! IF CLEANING A CHI-COIN GAME, TEST A SMALL SPOT FIRST AND WORK CAREFULLY! WHEN IM REBUILDING A HIGH MILEAGE GAME, I LIKE TO ROTATE THE HIGHLY WORN PARTS FROM 1+10 DIALS TO 100 & 1000 DIALS! ON DIGITAL GAMES, I RECOMMEND STOCKING UP NOW ON GAS DISCHARGE TUBES! THEY WILL SOMEDAY STOP MAKING THEM! MAZZCO HAS 6 DIGIT TUBES FOR 6¢!

9 SOLDER LAMP SOCKETS SHUT TO STOP DIMMING!

LAMP SOCKETS ARE ~~TWO~~ TWO PIECES, A SOCKET AND A BRACKET THAT ARE PRESS FIT TOGETHER! AS AIR WORKS INTO PRESS FIT SURFACES OVER THE YEARS, THEY CORRODE! A DROP OF SOLDER SHOULD BE MELTED BETWEEN THE 2! THIS IS EASY & QUICK IF YOU FIRST PREP THE METAL WITH LIQUID SOLDER FLUX OR A SMALL FILE! (5% HYDROCHLORIC ACID) THIS FIXES 90% OF DIM BULBS! THE OTHER 10% IS DIRTY INNER SOCKET SURFACE! CLEAN WITH DREMEL TOOL OR STEVE YOUNG'S CLEANING STICKS! IF THE PROBLEM IS IN THE BULB, I CLEAN THE BULB BASE WITH A GREEN PAD AND/OR SOLDER A NEW TIT ONTO THE BOTTOM OF THE BULB!



SHINEY! →
NEW TIT! ←
FINALLY, WIPE THE OIL FROM YOUR FINGERS OFF THE BULB TOP, HEAT WILL BUILD UP THERE!!!

10 BE CAREFULL WITH SOLDER!

DO NOT BELIEVE IT IS A SAFE PROVEN PRODUCT! WORK IN A WELL VENTILATED ROOM! DO NOT EAT WHILE SOLDERING! DO NOT SMOKE! DO NOT LEAVE BEVERAGES NEAR JOB SIGHT! DO NOT TOUCH YOUR FACE WHILE SOLDERING! EVEN IF YOU ARE VERY HUNGRY, DO NOT PICK YOUR NOSE! WASH YOUR HANDS AS SOON AS YOU ARE DONE! DO NOT USE A HIGH HEAT (OVER 700°) IRON! LEAD BUILDS UP OVER TIME IN YOUR BODY! BE CAREFULL! TO PROTECT YOUR EYES, WEAR GLASSES!

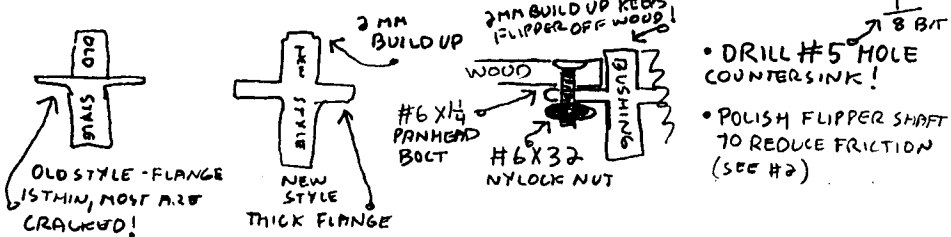
11 DON'T BUY CHEAP SOLDER!

I CAN ALWAYS RECOMMEND "KESTER" OR OTHER AMERICAN MADE 60-40 ROSIN SOLDER! RADIO SHACK IS ANOTHER GOOD BET! AVOID "OTY" OR ANY SOLDER FROM THE ORIENT OR IN AN UNMARKED CONTAINER! EXPECT TO PAY 6-10\$ PER LB! BUY 1B A.W.G FOR B16 JOBS + 22 A.W.G. FOR BOARD WORK!

12 STRAP A BOARD OVER BACKGLASS WHEN SHIPPING HEAD!

LUAN OR CHEAP-O THIN PLYWOOD COULD SAVE YOUR BACK GLASS! LARGE RUBBER BANDS OR CLOTH STRAPS WILL HOLD IN PLACE, DONT USE TAPE, IT WILL TAKE THE PAINT OFF THE CABINET WHEN YOU PULL IT OFF! USE PLASTIC STEELBAND TO HOLD HEAD AND BODY TO SHIPPING PALLET! GET TO KNOW A CARPET GUY! HE WILL GIVE YOU ALL THE SCRAPS YOU WANT! PAD EVERYTHING! IF YOU HAVE TO SHIP OR STORE A PLAYFIELD, GO TO A BYCYCLE STORE & GET FREE BYCYCLE BOXES, PERFECT SIZE! WHEN MOVING HEADS IN THE COLD, REMEMBER THE #1 KILLER OF BACKGLASS PAINT, RAPID TEMP. CHANGE! MOVE OUTSIDE IN STAGES, INSIDE, PORCH, OUTSIDE, TRUCK! ALWAYS WAIT AN HOUR BEFORE TURNING ON A COLD FROM THE OUTSIDE GAME!

13 REPLACE THIN-FLANGE FLIPPER BUSHINGS!



- DRILL #5 HOLE COUNTERSINK!
- POLISH FLIPPER SHAFT TO REDUCE FRICTION (SEE #2)

STEVE YOUNG HAS EM, WILD, MAYFAIR, MARZCO! EVEN IF YOUR OLD STRIE BUSHINGS LOOK OK, SHITCAN EM! NEW STRIE HAS A SLIGHT BUILDUP WHICH KEEPS FLIPPER UP AWAY FROM WOOD! DONT SCREW EM IN, BOLT THEM THRU!

14 SHITCAN SKANKY FEET! GREESE YOUR FEET!

OLD FEET RUINS FLOORS & CARPETS! STEAL THEM OUT OF PAC MAN MACHINES! ALL PARTS HOUSES HAVE EM! COAT THE THREADS WITH A GREESE TO PREVENT RUST! BALLY LUBE-IN-A-TUBE (MOLY GREESE) LITHIUM GREESE (SEARS)

15 CHEAP SUPER GLUE IS NO BARGIN!

I USE SUPER GLUE A LOT! THE ONLY ONE WORTH A SHIT IS BORDENS CRAZY GLUE IN THE TUBE! THE PEN IS WORTHLESS! CYANIDE GLUE WILL HURT YOUR EYES! ONE TIME, 2 FRAT BOYS PASSED OUT ON THE BACK STAIRS OF THE ARCADE! WE TOOK OFF THIER SHOES AND SUPER GLUED HANDS TO FEET! MUCH FUNNY! SAME GOES FOR TAPE! SCOTCH #33 OR 35 IS THE ONLY KIND TO USE!

16 TEMPERED GLASS! LEARN IT! LOVE IT! LIVE IT!

MARZCO SELLS IT FOR 8⁰⁰ A SHEET (YOU PICK UP, CHICAGO) PLATE GLASS IS NOT VERY STRONG AND BREAKS VERY SHARP! ON ANY GLASS, REMEMBER THE 10" RULE! LIFT TO YOUR FEET, THEN THE FLOOR! GO TO BUILDERS SQUARE + GET FOAM WEATHER STRIP + BEER SEAL! LOOK FOR GLASS MFG. SEAL OR "FLOAT MARKS" OR PING EDGE OF GLASS WITH FINGER + LISTEN

17 STORE YOUR GAMES ON FREE PALLETS!

IF YOU LEAVE YOUR MACHINES SITTING UP ON END IN A BASEMENT, GARAGE, OR STORE-IT, YOU MUST PUT THEM UP ON PALLETS! MANY PINHEADS HAVE TALES OF SUDDEN BROKEN PIPES OR FREEK FLOODS THAT LEFT THE BACKS OF THEIR GAMES SWELLED UP AND USELESS! GO OUT BEHIND AUTOPARTS STORES, DRUG STORE, OR SUPERMARKETS AND GET FREE PALLETS! THEN IT CAN FLOOD UP TO 3" AND YOUR GAMES STAY DRY! WHILE OUT ON PALLET RUNS, ALSO LOOK FOR OLD STORE DISPLAYS AND SHELVING THEY ARE THROWING OUT! ALL MY PARTS ARE STORED ON OLD COPPER-TONE DISPLAYS AND MOVIE STORE SHELVES!

18 SCREW 2ND KEY INTO GAME BOTTOM!

NEW LOCKS COME WITH 2 KEYS!
GRAB A #6 X $\frac{1}{4}$ WOOD SCREW AND MOUNT THE SPARE TO THE BOTTOM OF THE GAME! I ALSO SCREW INTO THE CASH BOX AREA, THE SPARE BACK DOOR KEY!

19 PREPARE TO REPLACE "FISH GLUE"

PINBALL CABINETS ARE MADE WITH A LOW QUALITY ORGANIC GLUE! AFTER ABOUT 20 YEARS, AT RANDOM, SOME CABINETS JUST COME APART! I LOVE TO BUY GAMES CHEAP WITH SPRUNG CABINETS, IT'S SUCH AN EASY FIX! ALL THE MITRED JOINTS STILL LINE UP, JUST SMEAR ELMERS YELLOW WOOD GLUE IN THE JOINT, PIPE CLAMP TOGETHER, WIPE EXCESS GLUE OFF, AND WAIT OVER NIGHT! GOOD AS NEW! THE 2 EASIEST CAB PANNELS TO REPLACE JUST HAPPEN TO BE THE 2 EASIEST TO REMAKE! BOTTOM LIGHT PLY SHEET AND BACK PANNEL!

20 22 GAUGE FLIPPER JUMP WIRE HAS GOTTA GO!

THE WIRES BETWEEN
FLIPPER END-OF-STROKE SWITCH AND COIL ARE NOT BIG ENOUGH
95% OF WILLIAMS GAMES FROM 60'S AND 70'S USE DINKY 22 A.W.G
JUMP WIRES! REMEMBER, FOR EACH 4 WIRE GAVGES YOU GO UP OR DOWN
YOU DOUBLE OR CUT IN HALF WIRE DIAMETER! SO IF YOU HAVE
SOME OLD 18 GAUGE HEAVY DUTY ZIP CORD AROUND, USE THAT! ALSO
CHECK THE WIRE GOING FROM TRANSFORMER LUG TO COIL VOLTAGE
FUSE! I ALWAYS REPLACE IT WITH DOUBLE STRAND OF 18 A.W.G.
(14 A.W.G.) ZIP CORD! ALSO REPLACE ANY BALLY FUSE CLIP THEY
MADE THEM SELFS (MOUNTED ON FLIMSY BAKELITE) WITH NICE LITTLE-
FUSE OR BUSS FUSE HOLDER!

21 TIGHTEN COIN DOOR HINGE!

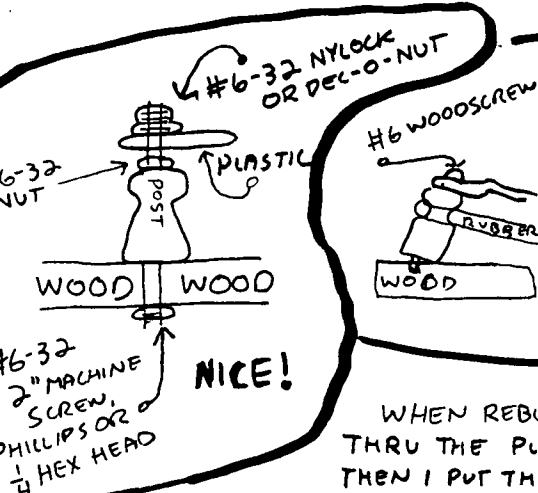
OPERATORS DONT! CHECK BOTH WHERE HINGE MOUNTS INTO
WOOD WITH #8 X $\frac{3}{8}$ WOOD SCREW AND WHERE DOOR SHELL
MOUNTS TO HINGE WITH MACHINE SCREW! WILLIAMS GAMES WITH TAIWAN
COIN DOORS (TAXI & FORWARD) ARE ALWAYS LOOSE!

22 LET YOUR GAME WARM UP! SEE #12

23 MODIFY GOTT. SYS. 1 POWERSUP

IF -12 VOLTAGE STOPS, ALL THE COILS IN THE WHOLE GAME PULL IN! BROOM!
INSTANT FRIED BOARD! THE DIVE ASS HEAT SINK ARRANGEMENT SHOULD
BE REPLACED WITH THE +5 PASS TRANSISTOR BEING MOVED TO A SMALL
REMOTE HEAT SINK! THE -12 REG. LEGS SHOULD BE CHECKED FOR INSULAT
AND ALL SOLDER JOINTS ON HEADERS NEED TO BE REFLOWED!
EXTRA HINT! GOTTLIEB SYSTEM 80 BUMPER DRIVER BOARDS NEED A
NEW CAP! 90% OF "FLAPPING" BUMBERS, COIL BURNOUTS, BLOWN FUSES, CAN
BE TRACED TO THIS 47 MFD CAP!

23 PLAYFIELD SCREWS!



OUCH! THE HOLE IS ALL EGGED OUT! THE RUBBER PULLS THE POST CROOKED, BENDING THE PLASTIC! SOME ADVOCATE FILLING THE HOLE WITH TOOTH PICKS OR WOOD PUTTY, BUT WHY?

WHEN REBUILDING PLAYFIELDS I RUN #6 "STUD" THRU THE PLAYFIELD FROM THE BOTTOM! THEN I PUT THE POST AND PLASTIC ON TOP OF THAT AND FIRMLY NUT EACH! NOW I CAN ENDLESSLY!

TAKE IT APART TO CHANGE RUBBER OR BULBS AND NEVER WEAR OUT HOLE! START WITH A HAND HELD SCREWDRIVER WITH A #5 BIT ($\frac{1}{8}$)! DRILL A #5 HOLE FROM THE TOP DOWN WHERE THE ORIGINAL HOLE WAS! DO NOT USE A HIGH SPEED TWIST DRILL, IT WILL BURST GUT THE BOTTOM AND CHEW UP A WIRE BUNDLE! THEN USE SAME HAND HELD SCREWDRIVER TO FEED INTO #5 HOLE A 2" #6 BOLT FROM THE BOTTOM UP! PLACE THE POST ON THE STUD, NUT IT WITH AN ORDINARY #6 NUT, PUT THE ROLL OVER GUIDE APRON OR PLASTIC SLEEN CARD ON TOP, AND ELASTIC NUT IN PLACE! IF YOU INCONUNTER A RELAY OR STEP UNIT IN THE WAY OF YOUR HOLE, JUST USE A PAN HEAD BOLT AND COUNTER SINK SO IT LAYS FLUSH WITH THE WOOD! TRY IT ONE ONE GAME YOU'LL NEVER GO BACK! BUY LARGE QUANTITIES OF HARDWARE FROM "FASTENER SUPPLYS" IN YELLOW PAGES OR FROM ELECTRONIC SURPLUS IN DAYTON FOR 1.25 A POUND!

6-32 X 2 NEWARK P.N	31F2195	5.76	PER 100
6-32 NUT " "	31F2209	4.45	PER 100
6-32 ACORN NUT	50N6486	16.95	PER 100

25 A.C. PARTS - D.C. PARTS!

MAGNET COILS ON EM GAMES CONTAIN A BRASS OR COPPER CLADDING THAT RETAINS THE MAGNETIC FIELD THRU THE ϕ CYCLE OF THE A.C. WAVE! IF THIS COMES LOOSE OR WEARS OUT, RELAY WILL START TO HUM! REPLACE COIL! A PHONE CALL TO STEVE YOUNG OR MYSELF CAN CROSS 95% OF ALL COILS! D.C. COILS CONTAIN NO SUCH COPPER SLUG, BUT DO HAVE A DIODE ACROSS THE WINDING! AS THE MAGNETIC FIELD COLLAPSES, A "SPIKE" OF REVERSE VOLTAGE COMES OUT OF THE COIL! THE DIODE SUPPRESSES THIS! DON'T IGNORE THIS! ON MOST RELAYS, THERE IS A BRASS OR COPPER WASHER BETWEEN THE COIL AND THE RELAY FRAME! THIS, ALONG WITH THE BRASS SCREW KEEPS THE FRAME ISOLATED MAGNETICALLY! IMPORTANT! AS RELAYS ON GOTTLIEB GAMES NEED ONLY TO HAVE COIL REMOVED, CLEANED, DE-MAGED AND THE STRIKE PLATE WEAR SPOT COVERED WITH MYLAR! DO NOT ATTEMPT TO TAKE STEPPING PART OF RELAY APART!

26. REMOVE BATTERYS

SOLID STATE GAMES HAVE BATT-TREES TO HOLD IN MEMORY OVER NIGHT! LEFT ALONE FOR LONG PERIODS THEY WILL LEAK AND CORRUDE! POP EM OUT OR BREAK THEM OFF AND TAKE THEM TO BE RECYCLED OR HOLD THEM, DO NOT THROW BATTERYS IN GARBAGE! I USE AA NIKAOS TO REPLACE HIGH PRICED "DATA SENTAY" OR LONG BAMP BATT-TREES!

27 PROP STICKS ARE BAD!

WHEN WORKING ON PLAYFIELDS, DON'T USE THE PROP STICK! PULL THE GAME TO A SOLID SERVICE POSITION! PLAYFIELD FLEX CAUSES PAINT CRACKING!

28 DON'T MAKE FUN OF WAYNE NEWTON!

HE IS A GOD IN VEGAS! IF WE FIND YOU DOING THIS,
WE WILL KICK YOUR ASS!

29 COIL SIATION

SOLENOID COILS MUST HAVE A
FERROS PLUNGER INSIDE THEM
OR THEY DRAW 2-3 TIMES THE CURRENT! MAGNETIC FIELD
IS PRODUCED AT 20-100% OF SIATION! IF PLUNGER IS
WORN, REPLACE! PLATED PLUNGERS SHED LESS CARBON!
POLISHED PLUNGERS HAVE LESS FRICTION! NEW SLEEVES
(NYLON) EVEN LESS!

30 COIL MODIFKATION

BALLY-WILLIAMS
+ CHI-COIN COILS
ALL HAVE THE WIRE GAUGE AND # OF TURNS ON THE
WRAPPER! GOTTLIEB COILS ONLY HAVE DRAWING # BUT CAN BE
CROSSED WITH CHART IN NEWER PARTS MANUALS! FOR MORE
POWER, SMALLER A.W.G. OR LESS TURNS! MOST COILS ARE
MESURED WITH OHMS, BUT KEEP IN MIND THIS IS FOR COMPARISON
ONLY, INDUCTANCE IS NOT MESURED IN OHMS AND OHMS LAW
CAN NOT BE USED TO FIGURE INDUCTIVE LOADS! THE SIMPLEST
THING TO DO IS LOP OFF 20%, NO MORE, OF THE WIRE, BARE PAINT
OFF THE END, AND RESOLDER TO LUG!

31 REPLACE FLIPPER LINKS WITH NYLON OR STEEL!

FLIPPER LINKS ARE MADE OF BAKELITE, A SOFT, CHEAP, LOW GRADE
PLASTIC! THE FACTORIES CLAIMED THEY USED IT DUE TO IT'S HIGH
RESISTANCE TO HEAT, BUT THE REAL REASON WAS IT'S LOW COST!
I BUY SHEET NYLON FROM A PLASTIC HOUSE OR USE OLD PROP STIKES
AS STEEL STOCK! SHAPE ON BENCH GRINDER, COAT HOLES WITH CYANIDE BLUE!
HEAT PLUNGER, KNOCK OUT ROLL PIN WITH A PUNCH, CRADLED IN A VISE!
WARNING! STEEL LINKS HAVE A DIFFERENT FEEL THAN PLASTIC! FOR
TRUE ORIGINAL, USE PLASTIC!

32 EQUALISE GROUNDS!

DIGITAL GOTTLIEB GAMES WERE THE WORST! THE GROUNDS ALL TERMINATED ON A STRIP IN THE BOTTOM OF THE GAME! CLIP OFF PRESS LUGS AND SOLDER THEM ON! STRAP THE GROUND OF GOTTLIEB POWER SUPPLYS TO THE METAL LINER OF THE CABINET! ON ALL DIGITAL GAMES, CONNECT ALL GROUNDS AT ALL TIMES! SCREW IN PLACE ALL BOARDS! FLOATING GROUNDS CAUSES MANY "PHANTOM" PROBLEMS THAT DRIVE YOU CRAZY!

33 TOOTHBRUSH YOUR POSTS!

WILLIAMS POSTS FROM LATE 70'S EARLY 80'S WITH DEEP HORIZ. RUTS AND GOTTLIEB METAL POSTS OF MID 60'S ARE A SNAP TO CLEAN WITH AN OLD TOOTHBRUSH! POLISH EM UP- SEE #2!

34 KEEP YOUR GAME OUT OF SUN!

IT FADES THE PAINT! IT MELTS THE PLASTIC! IT WEAKENS THE BONDING OF PAINT TO WOOD! COVER YOUR GAMES WITH OLD SHEETS! WHEN TRANSPORTING YOUR GAME IN SUNLIGHT, PUT WHITE BUTCHER PAPER OR NEWSPAPER BELOW GLASS!

35 NICE KNOCKERS!

AS A KID, I LIVED FOR THE SOUND OF THE FREE
PLAY KNOCKER! BUT NOW, WHEN I GET A GAME IN, IT ISN'T AS LOUD AS I REMEMBERED! WHAT HAS HAPPENED, THE KNOCKER IS NO LONGER BEING HELD TIGHTLY TO THE SIDE OF THE CABINET! TIGHTEN THE SCREWS, OR EVEN BETTER YET BOLT IT THRU! LOP OFF 20¢ OF THE WIRE (SEE # 23 + # 30) AND IT SOUNDS LIKE DETROIT ON A SATURDAY NIGHT!

36 REINK BUMPER CAPS!

USE A SHARPIE OR SUPER SHARPIE!

37 BEERSEAL YOUR GLASS!

GO TO HOME ~~BASE~~ BASE + BUY SEVERAL WIDTHS
& THICKNESS OF WEATHER STRIPING + SEAL OUT BEVERAGES!

38 OIL METAL MOTOR GEARS!

WHEN YOU REBUILD A GAME, CHECK THE MOTOR! IF
IT HAS NO FIBER GEARS, DROP SOME LIGHT MACHINE
OIL ON ALL EXPOSED GEARS BUT NOT ON THE ARMATURE
OF THE MOTOR! IF AT ANY TIME YOU HAVE MOTOR FAILURE, DON'T
WASTE YOUR TIME TRYING TO FIX IT! TAKE THE MODEL #
STAMPED ON THE FRAME AND CALL THE MIGHTY MOTOR MEN AT
MULTI-PRODUCTS! IN 3 DAYS, FOR \$28.00 YOU WILL HAVE AN EXACT
REPLACEMENT MADE NEW! TOTAL COOLNESS!

39 COIN LOCKOUT COILS!

ARE NOT NEEDED! REMOVE THEM AND ALL THE
LINKAGE PARTS ON THE DOOR! DO NOT OPEN A
COMMON AND CAREFULLY TAKE OFF!

#40 DO NOT BUY 32 VOLT
FUSES! ONLY BUY 250VOLT
FUSES!

VOLTAGE RATING ON FUSES IS THE HIGHEST VOLTAGE
FUSE WILL "SPRING APART" + OPEN! 32 VOLT FUSES
ARE CHEAPER BUT MAY NOT SPRING APART! THEY
MIGHT MELT INTO A PUDDLE IN THE BOTTOM OF THE
FUSE + CONTINUE TO CONDUCT!

#41 BUY DIODES WITH MUCH HIGHER P.I.V.
THAN YOU NEED!

R.M.S. VOLTAGES TRUE PEAK VOLTAGES ARE 25-
40 PERCENT HIGHER THAN INDICATED!

USE 1N4007 NOT 1N4004

USE 200 P.I.V. 35 OR 50 AMP BRIDGES, NOT 50 OR 100 P.I.V.

IMPORTANT → ZENER ← READ THIS!

↓
ZENER DIODES DO NOT APPLY TO ABOVE!

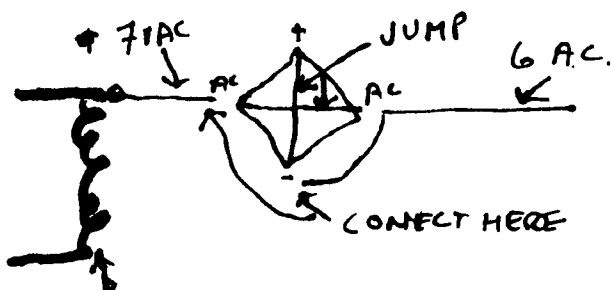
BUT ONLY LISTED VOLTAGE ZENERS!

#42 ROTATE CHIME PARTS

TURN CHIME OVER TO AVOID WEAR! CLEAN BLACK
CARBON GOO OFF ALL METAL PARTS! REPLACE
GROMMETS WITH NEW FROM ELECTRONICS STORE?
WRAP OLD FLIPPER AROUND PLUNGER FRAME
TO REPLACE CHEEP-O FOAM!

44 LOWER BULB VOLTAGE

#44 BULB LIFE AT 6.3 V AC = 40000 HRS.
AT 7 VOLTS = 5000 HRS AT 5.8 = 100000 HRS
GO TO RADIO SHACK! GET A 35 AMP BRIDGE RECTIFIER!
USE 18 AWG. WIRE TO JUMP (+) TO (-)
AND (AC) TO (AC)! LIKE ELTON JOHN, YOU ARE
NOW BI-CONDUCTING! LITTLE ELECTRONS MARCH
INTO BRIDGE, BOUNCE AROUND, MARK OUT ABOUT
2 VOLT LOWER! EXTRA VOLT IS DISSIPATED AS HEAT,
SO BE SURE TO MOUNT BRIDGE TO HEAT SINK
OR METAL PLATE



TRANSFORMER SECONDARY

45 NOTCH FLIPPER LINKS

NEW WILLIAMS FLIPPERS (FIREPOWER & UP)
GOTTLIEB FLIPPERS WITH SCIM BAT (BONE BUSTED
& UP) SHOULD HAVE ALL NEW PARTS INSTALLED WHEN
YOU GET THESE GAMES! AS THESE PARTS WEAR, THE LINK
WILL GET TOO CLOSE TO THE METAL BRACKET HOLDING
FLIPPER COIL AND WILL BASH! USE A BENCH GRINDER
TO CUT A 3MM NOTCH ALLOWING MORE
CLEARANCE!



46 ZAP GOTT. DISPLAYS BACK TO LIFE!

MANY TIMES GOTTLIEB "BLUE" DISPLAYS WILL GET DIM! ON SCHEMATIC FIND WHICH PINS OF THE GLASS TUBE PROVIDE FILIMENT VOLTAGE! LOOK IT UP EVERY TIME! THERE WERE SEVERAL SUPPLIERS OF THESE TUBES! IT WILL SAY "4.2 VAC" (LESSON SMALL DISPLAYS) DO NOT CONFUSE WITH OFFSET VOLTAGE THAT IS D.C.! GET 2 JUMP WIRES! REMOVE DISPLAY FROM GAME! TAKE COIN CHUTE LIGHTS VOLTAGE 6.3 VAC. ON FRONT DOOR & JUMP TO FILIMENT VOLTAGE ON TUBE! TURN GAME ON! WAIT ABOUT 5 MIN.'S FOR CRUD TO BE BURNED OFF FILUMENT! REINSTALL IN GAME.

47 MAKE YOUR OWN MASTER LOCKS FOR FREE!

MOST PINBALLS FEATURE "FORT" LOCKS! TAKE THE CYLINDER OUT OF THE LOCK AND WITH A SMALL FILE, TAKE METAL OFF EACH PIN UNTIL IT IS FLUSH WITH THE CYLINDER! THE ORIGINAL KEY WILL STILL WORK IF YOU EVER SELL THE GAME! MOVE NOW FORT LOCKS TO HEAD KEY LOCKS!

48 CLEAN MOTOR "HOME"

ON EVERY EM SCORE MOTOR IS A N.O. CONTACT THAT RUNS THE MOTOR BACK TO THE "HOME" POSITION! THE RELAY THAT STARTED THE MOTOR DROPS OUT BEFORE THE END OF EACH CYCLE, LEAVING THE MOTOR "HOME" SWITCH TO HANDLE THE EXTREME VOLTAGE SPIKE OF THE MOTOR'S MAGNETIC FIELD COLLAPSING! IT IS EASY TO FIND, IT'S THE DIRTY PITTED ONE! IF IT'S REALLY BAD, REPLACE IT! CLEAN ONLY WITH A SMALL FILE!

CHEMICALS!

"DEADLY BLUE" TRADE NAME "GEMINI PLAYFIELD CLEANER" IS A LIGHT BLUE COLOR, THIN & SMELLS A LOT LIKE KEROSENE! DO NOT USE ON PLAYFIELDS, RAMPS, MYLARS, CABINETS, OR PLASTICS! IT DOES A GREAT JOB AS A RUBBER CLEANER!

WILDCAT #125 MILKY WHITE, THIN, SAYS "RECOMMENDED BY BALLY" ON LABEL! THIS RECOMMENDATION WAS MADE IN 70'S, BEFORE MYLARS + DIAMOND PLATE FINISHES! IS OK ON ORIGINAL TUFF-COTE AS A CLEANER, BUT DOES NOT PROVIDE ANY WAY PROTECTION! DO NOT USE ON RAMPS, DIAMOND PLATE, MYLARS OR PLAYFIELD PLASTICS

LO-VOL CAR WAX LOOK FOR CARNUBA ON LABEL! SNIFF SEVERAL BRANDS, THE ONE THAT SMELLS LEAST OF PETROL IS A WINNER! "MOTHERS" MAKES A GOOD CARNUBA WAX! I RECOMMEND CAR WAX TO HOME SALES, BECAUSE EVERYBODY HAS IT AND IT'S SAFE ON PAINT! DO NOT USE ON RAMPS!

NOVUS #2 ALSO MADE BY GEMINI! COMPLETELY INERT! CONTAINS NO U.O.C.'S! WILL NOT YELLOW RAMPS! WILL NOT EAT MYLAR GLUE! RETURNS P.F. PLASTICS TO NEW CONDITION! HIGHLY RECOMMENDED FOR NEWER GAMES!

JOHNSONS PASTE WAX IN YELLOW CAN IN AOR CARE SECTION OF HARDWARE STORE! ORGANIC BEE'S WAX WITH SLIGHT AMOUNT OF PETROL! GREAT ON ORIGINAL TUFF COAT! WARNING! REQUIRES MUCH HAND BUFFING AND TAKES AN HOUR TO DRY! ALSO GREAT ON CABINETS WITH MACHINE BUFF! DO NOT USE ON RAMPS, MYLARS, P.F. PLASTICS

KNOW YOUR SURFACES!

BALLS ARE HARD ON EVEN THE MIGHTIEST OF SURFACES! BY KNOWING WHAT EACH SURFACE IS, YOU CAN CHOOSE THE RIGHT CLEANER TO MAKE IT LOOK GOOD

ORIGINAL TUFF-COAT ON ALL GOTTIEB GAMES! ON ALL WILLIAMS GAMES UP TO WHIRLWIND! ON ABOUT HALF OF WILLIAMS GAMES WHIRLWIND - FUNHOUSE! CLEAN + WAX WITH CAR WAX! FOR ADDED PROTECTION USE JOHNSONS PASTE WAX!

DIAMOND PLATE ALSO KNOWN AS U.S. TOP COAT "STEALTH" ON DATA EAST

ON MOST WILLIAMS GAMES WHIRLWIND - FUNHOUSE ALL FROM FUNHOUSE ON! GREAT STUFF! NO HALF MOON CRACKS! NO LONG VERTICAL CRACKS! CLEAN ONLY WITH NOVUS #2! WAX WITH CAR WAX

MYLAR OPTICALLY CLEAR FILM WITH STICKY BACK APPLIED AT FACTORY! VERY DURABLE BUT HEAT FROM LENSES CAUSES GLUE TO CRYSTALLISE! ALSO, ANY V.O.C.'S ON EDGE WILL CAUSE IT TO PEEL! CLEAN ONLY WITH NOVUS #2 WAX NOT NEEDED! REMOVE WITH MINERAL SPIRITS + TOOTH BRUSH SLOWLY!

RAMPS! VACUFORMED PLASTIC! DO NOT CLEAN WITH ANYTHING WITH V.O.C.'S! NOVUS #2 OR #1 WORKS WELL!

P.F. PLASTICS! AGAIN - IF IT'S PLASTIC, CLEAN IT WITH A PLASTIC CLEANER! NOVUS!

CABINETS BEFORE MID 80'S ALL CABINETS WERE ENAMEL PAINT - EASY TO CLEAN + WAX!

BUT SINCE MID 80'S BE CAREFUL! TEST CLEAN IN A SMALL SPOT IN BACK! ON NEWEST GAMES WITH "STICKERS", NOT PAINT USE WINDEX!

LEGS CLEAN RUST OFF WITH TURTLE WAX CHROME POLISH! BEAD BLAST PAINTED LEGS + REPAINT! POLISH PLATED LEGS!

BULB #	BASE HEAD	VOLTS	AMPS	MSCD OR EFC	HOURS RATED LIFE	PRICE	COMMENT
44	BAY T-3 1/4	6.3	.25	.90	3000	75¢	STANDARD BULB
47	BAY T-3 1/4	6.3	.15	.50	3000	69¢	LONGER LIFE DIMMER
1847	BAY T-3 1/4	6.3	.15	.38	5000+	81¢	LONG LIFE VERSION OF #47
55	BAY 6-4 1/2	7	.41	2.0	500	1.41	DO NOT USE! WAY TOO HOT!
46	SCREW T-3 1/4	6.3	.15	.50	3000	1.26	SAME AS #40 40'S GOTTA GAMES
1866	BAY T-3 1/4	6.3	.25	.65	5000+	1.35	LONG LIFE
455	BAY 6-4 1/2	6.3	VARIES BY -MFG-		500	2.10	BLINKS - SHORT LIFE! 6VDC O.K
555	WEDGE T-3 1/4	6.3	.25	.90	3000	93¢	WEDGE EQUIV OF #44
51	BAY 6-3 1/2	7.5	.22	1.0	1000	1.53	HOURS LONGER AT 6.3V - BUMPER!
53	BAY 6-3 1/2	14.4	.12	1.0	1000	1.53	DIM IN BGLASS LAST LONG - COOL!
194	WEDGE T-3 1/4	14.0	.27	2.0	2500	90¢	DIM IN BGLASS LASTS LONG + COOL
756	BAY T-3 1/4	14.0	.08	.31	15000	1.95	DIM IN BGLASS LAST LONG + COOL!
89	SINGLE CONTACT BAY-58	13.0	.058	6.0	750	1.32	FLASH LAMP
67	4 4 SAME	13.5	.059	4.0	5000	1.32	LONG LIFE FLASH LAMP
159	WEDGE T-3 1/4	6.3	.15	.34	5000	1.45	GOTT-60'S BUMPER! REPLACE WITH 555
666	CLOVEN HOOF	6.66	.666	FUCKIN BRIGHT!	FOR EVER	YOUR SOUL	FIRE + BRIMSTONE!
2200	WIRE TERMINAL T-1714	5	.06	.15	25000	42¢	XENON TUBE
1683	SINGLE CONTACT BAY-58	28	1.02	32	500	42¢	HIGH SPEED BEEMIE LAMP
	J-8						