

Raker

Appliance Repair Professionals, Inc.

**Automatic Washers
Whirlpool, Kenmore, KitchenAid, &
Roper**

Manual 2

Harry D. Raker

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WARNING

SAFETY PRECAUTIONS

Safety is very important when working on any appliance .

Disconnect power before servicing any appliance.

Always keep the work area and your shoes dry.

All appliances have sharp edges and should be handled carefully.

Before working on any gas appliance extinguish all open flames and before attempting any gas associated repair, cut off the gas feed.

Always sniff for gas leaks and soap bubble test any parts that may have been disturbed by repair work.

To minimize any potential buildup of gas in case there is a leak, always have the room open to the outside.

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Automatic Washers (cont)

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Whirlpool & Kenmore Washing Machines

Let's finally get into some real specifics. We will begin with the most popular brand in the United States today, the enduring Kenmore. Kenmore washers are sold by Sears. Many people know that the Whirlpool Corporation makes Kenmore washers and, in fact, have for over 35 years! Of course, Whirlpool also sells under its own name, and that of Roper and Kitchen-Aid. However, the bulk of its production gets a Kenmore label.

For many years, Whirlpool washers used the same basic design. It underwent various modifications to bring down production costs, but the basic theory remained the same. The early Whirlpools are referred to as "belt-driven" models. During the mid 80's a completely redesigned washer gradually replaced the old standby design.

The newer style is called the "direct-drive" model. We are going to begin with the older style, because it still dominates the laundry rooms of America. After extensive study of the belt-drive model, we will advance to the current, direct-drive design and study the changes.

The Belt- Driven Whirlpool Washer

Looking at the exploded view of the belt-driven Whirlpool for the first time can be frightening. A great many moving parts are visible, and it appears very complicated. This is only partially true. Once the functions of all the parts are understood, diagnosis become routine.

In contrast, the seemingly simpler designs of direct-drive models and other brands are actually more difficult to diagnosis. Their underlying operation is often hidden.

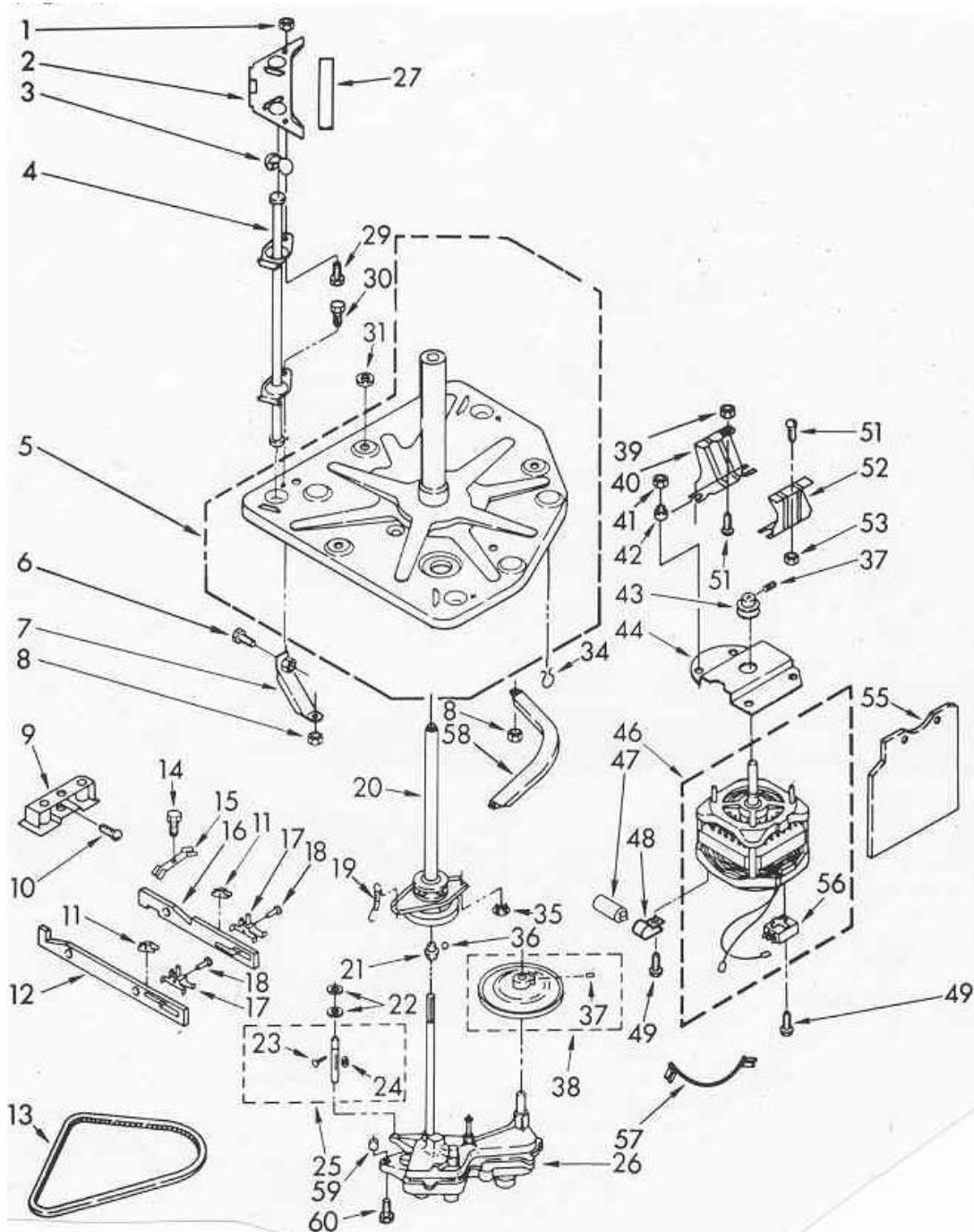
Typical Whirlpool Washer

(Fig 021-01)



Exploded View of a Belt-Driven Whirlpool

(Fig. 021-02)



Key to Exploded View

TYPICAL DRIVE SYSTEM PARTS

Illus. No.	DESCRIPTION	Illus. No.	DESCRIPTION	Illus. No.	DESCRIPTION
1	Nut, # 5/16-18	21	Support, Spin Tube	41	Nut
2	Cover, Front & Rear Gusset	22	Washer	42	Grommet, Motor Bracket (4)
3	Ball, Suspension (6)	23	Pin, Roll	43	Pulley, Motor
4	Rod, Suspension (3)	24	Roller, Basket Clutch Shaft	44	Shield, Motor (upper)
5	Baseplate & Centerpost	25	Shaft, Basket Clutch	46	Motor
6	Screw	26	Gearcase	47	Capacitor, Motor Start
7	Brace, Baseplate	27	Pad, Gusset Cover (6)	48	Clamp, Capacitor
8	Nut, # 5/16-24	29	Bolt, # 5/16 x 1 (3)	49	Screw, Motor Grounding
9	Magnet		Bolt, # 5/16 x 5/8 (2)	51	Bolt, # 3/8-16 x 3/4
10	Screw		Bolt, Snubber (1)	52	Bracket, Motor Mounting
11	Guide, Cam Bar	30	Bolt, # 5/16-24	53	Nut, # 3/8-16
12	Bar, Cam (Spin)	31	Gasket, Tub (7)	55	Shield, Motor
13	Belt "V"	34	Clip, Harness	56	Switch, Motor
14	Screw, # 1/4-28 x 1/2	35	Retainer, Brake Yoke	57	Wire, Jumper
15	Spring, Brake	36	Ball	58	Brace, Manifold (1) Brace, Motor (1)
16	Bar, Cam (Agitator)	37	Setscrew, # 5/16-18 x 1/2	59	Spacer, Stud & Gearcase
17	Plunger	38	Pulley, Main Drive	60	Screw & Washer
18	Rivet	39	Locknut, # 3/8-16		
19	Spring, Brake Yoke	40	Bracket, Motor Mounting		
20	Basket Drive & Brake				

The Drive System (Overview)

Enough philosophy, first look at the drive system. It is all hung below the base plate (# 5 on the exploded view) and is the source of most service calls. The biggest single item in the drive system is the transmission. The transmission casting serves as a mounting platform for the clutch, pump, and shift mechanisms.

Looking into the rear access panel of a running washer reveals a “V-belt” driving a series of pulleys and a funny looking device that is wiggling rapidly back and forth in time with the belt and pulleys. Lots of things seem to be going on at the same time. We will break the mechanism into sections and consider each one individually.

Sandwiched between the transmission top (#26) and the base plate is a basket drive assembly and brake (#20). The basket drive is actually the clutch of the washer. The large pulley at the bottom is driven by the belt and turns a long tube. The top of the long tube is bolted securely to the clothesbasket. Most of the basket drive tube is hidden inside the center of the wash basket.

Item (#9) the magnet or “wigwag” assembly is really the brains of the drive system. (This is the strange wiggling device.) It’s two little solenoids control pumping, agitation, and spin. The two cam bars (#’s 12 & 16) translate a signal from the timer into sliding mechanical action.

Whirlpool is unusual in having two solenoids. Back in 50 and 60’s Speed Queen and Bendix did, but only Whirlpool continued into the 80’s. One is the “wash solenoid” and the other the “spin solenoid”.

The wig-wag solenoid pair is mounted on a stubby transmission output shaft and wig and wag back and forth with the gears of the transmission.

A shift pin (#25) is operated by the spin solenoid cam bar (#12) that engages and disengages the basket drive. It operates exactly like the shift pin on a manual clutch automotive transmission. Looking from the rear the spin solenoid is on the left.

The wash solenoid (on the right) operates the wash cam bar (#16). The wash cam bar motion performs two functions. First it moves the pump shift arm between recirculate and drain positions, and second, it operates the transmission control pin. The control pin shifts the transmission in and out of agitation.

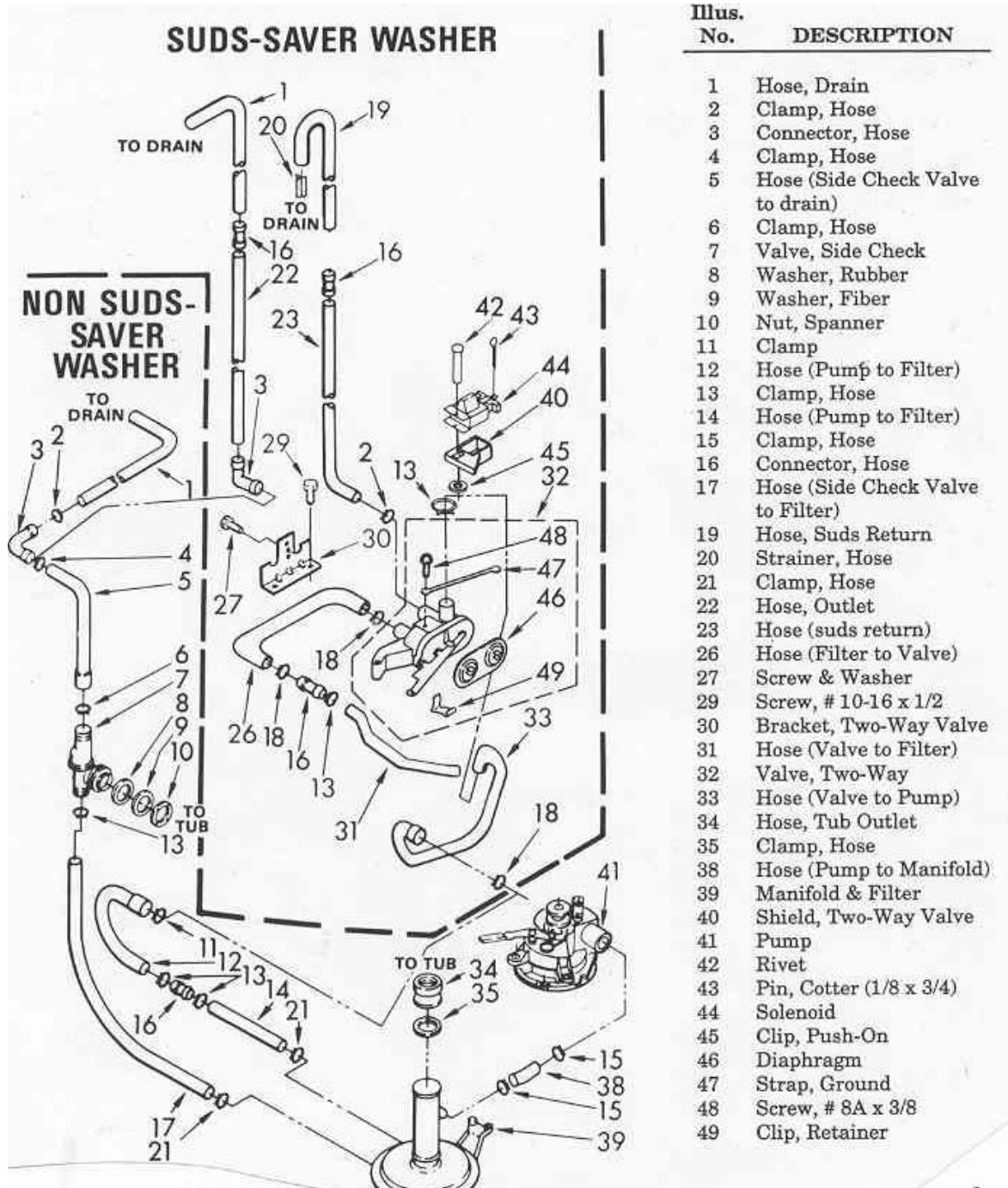
All of these components and their operation can easily be seen through the rear access panel. Of course don’t forget the belt and drive motor (#’s 46 & 13). Their operation is obvious.

Note: The motor always runs in the same direction. This simplifies the timer and diagnosis of potential motor problems. The timer does not need to reverse the motor direction as it does on most other brands and direct-drive Whirlpool.

The other key item is the pump (#41), which is shown on the following water and drain system exploded view:

Exploded View of a Belt Driven Whirlpool Water System

(Fig. 021-03)



The Sequence of the Operation

To understand how these components interact it is informative to go through a sequence of operation.

⌘ As with all automatic washers, with the machine on in the agitate cycle, it begins to fill while the motor and drive system sit idle.

⌘ Once the washer is full of water and has satisfied the water level control, the motor starts and simultaneously the wash solenoid activates. The wash cam bar moves and engages the transmission. The same cam bar motion shifts the pump arm out of the drain position and into recirculate.

⌘ The washer continues to agitate until the timer reaches the end of the wash cycle.

⌘ At the end of the wash cycle, the wash solenoid drops and switches the pump into the drain mode. At the same time, the solenoid disengages the transmission. The washer sits in an idling mode as the water drains. The agitator and the clothes basket sit still. The motor, belt, and pump continue to run draining the washer.

⊗ When the washer drops to about 1/3 full, the water level control clicks to empty. At that point, the spin solenoid pulls in and shifts the washer into spin.

(Note: If you lift the lid, spinning will stop, because the lid safety switch breaks the circuit to the spin solenoid. Also, if the water level increases as centrifugal force throws water up against the side of the washer, it may shift out of spin for a few moments and then go back into the idling and drain mode.)

Gradually the spin speed increases and more water gets drained out. As the speed of the basket increases, more and more water is squeezed out of the clothes. It goes down into the pump system and is drained into the sink.

The same sequence repeats for the rinse cycle and then a second and longer spin. Whirlpool has another feature. During the early parts of the last spin, water is sprayed into the basket to flush out soap suds left on the surface of the clothes. This is known as the “spray rinse” cycle. Spraying water is activated for periods of 15 seconds during the final spin.

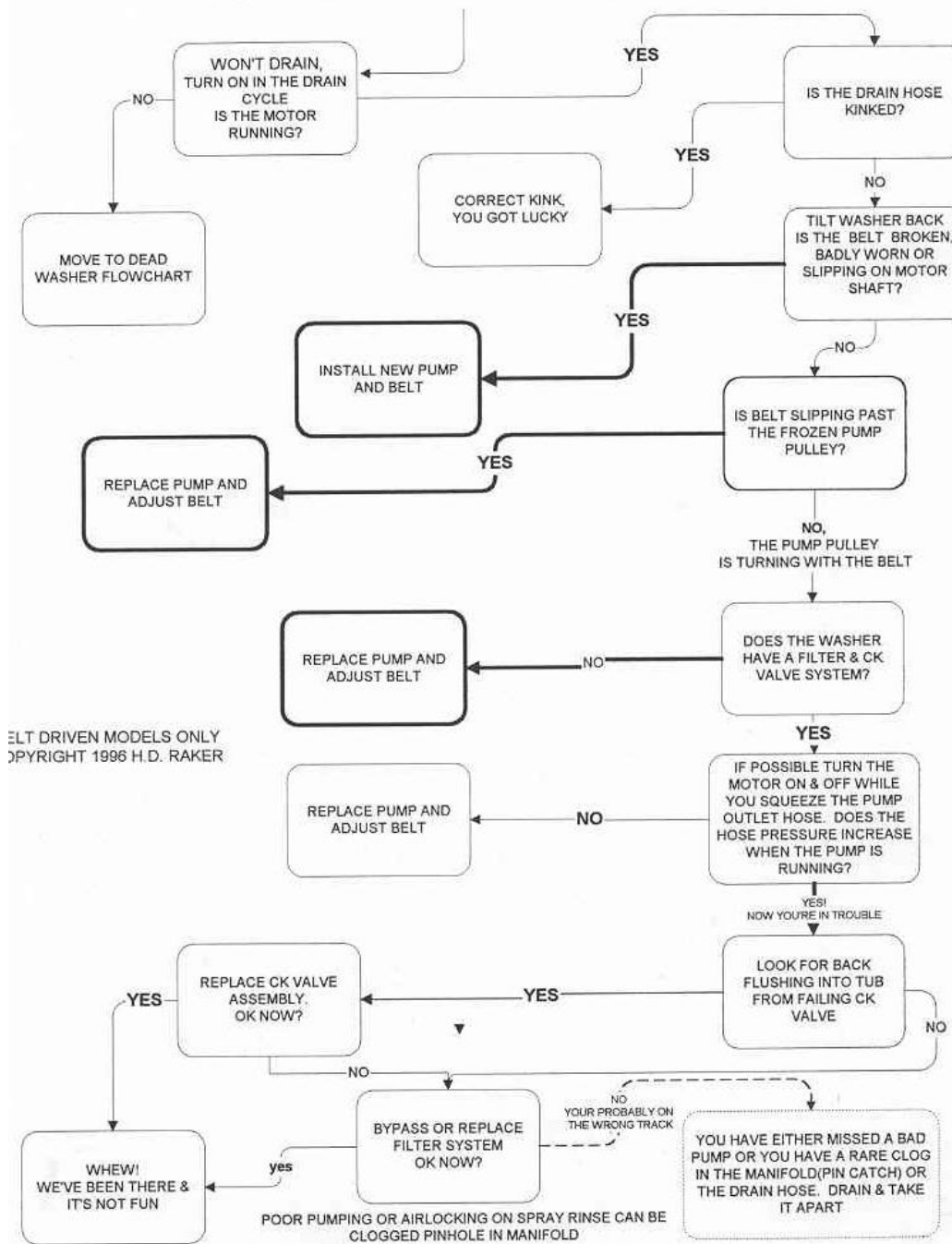
In review, we have the following key components. They are a:

1. single-direction motor.
2. belt.
3. wash solenoid.
4. spin solenoid, (together known as a wigwag).
5. pump.
6. transmission.
7. timer controlling the functions.

These are the key components to a belt-driven Whirlpool and the source of most drive system problems.

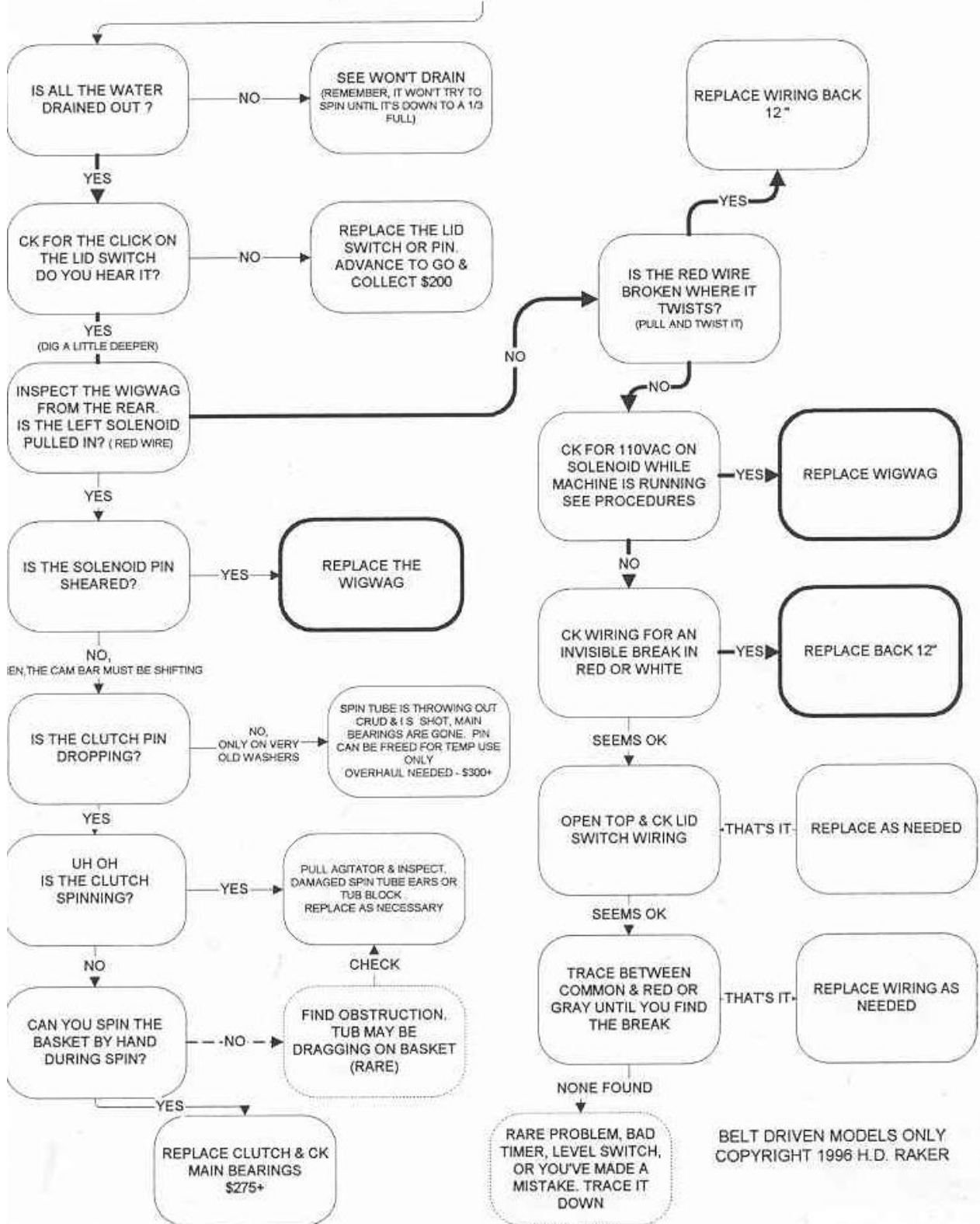
Flowcharts are very useful diagnostic tools. Using a flow chart allow you to quickly trouble shoot and diagnose the likely cause of trouble. The following charts are designed with the most common problems highlighted, indicating the highest priority.

KENMORE WASHER WON'T DRAIN



KENMORE WASHER WON'T SPIN

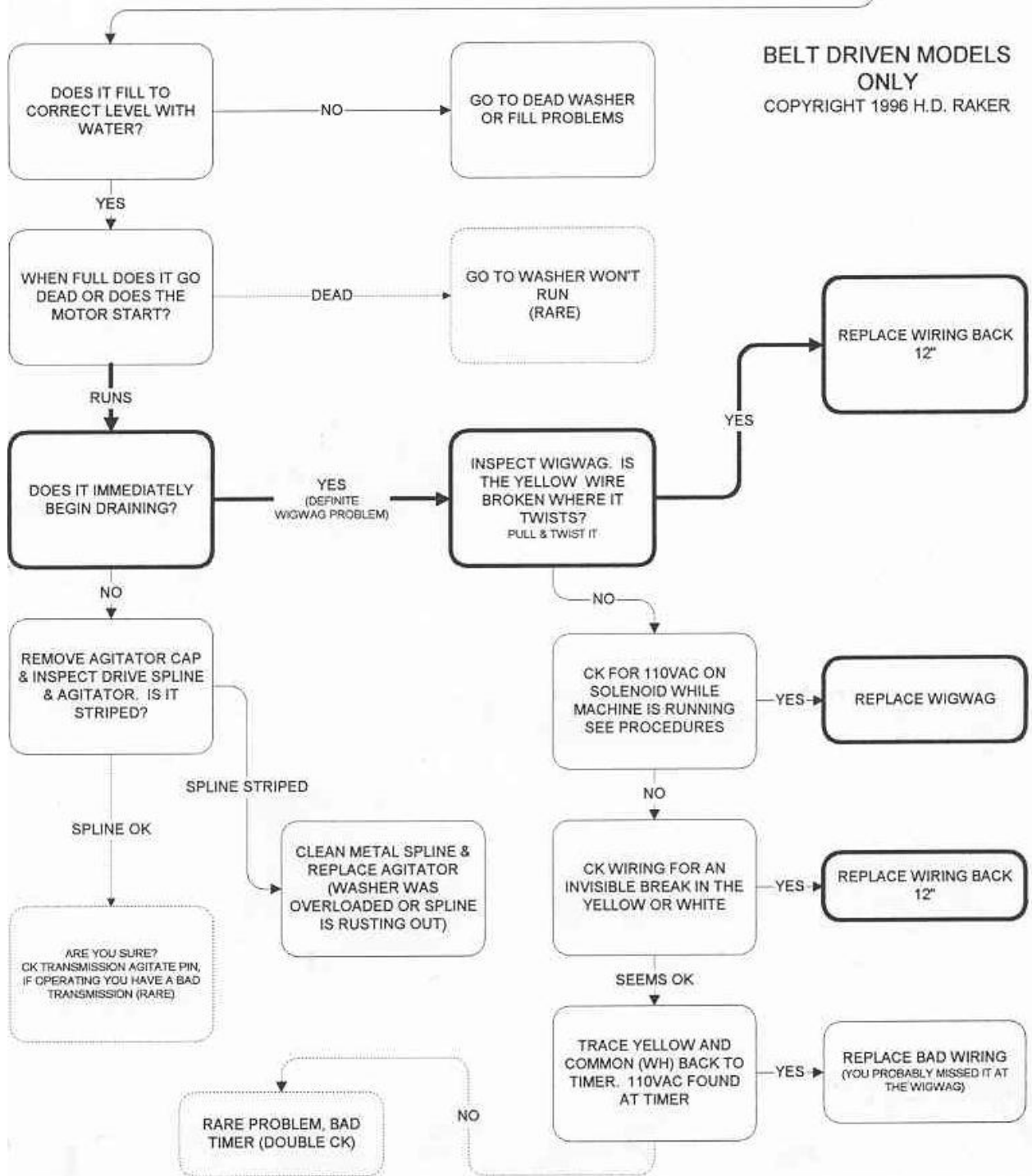
(MOTOR RUNNING & BELT RUNNING)



KENMORE WASHER WON'T AGITATE

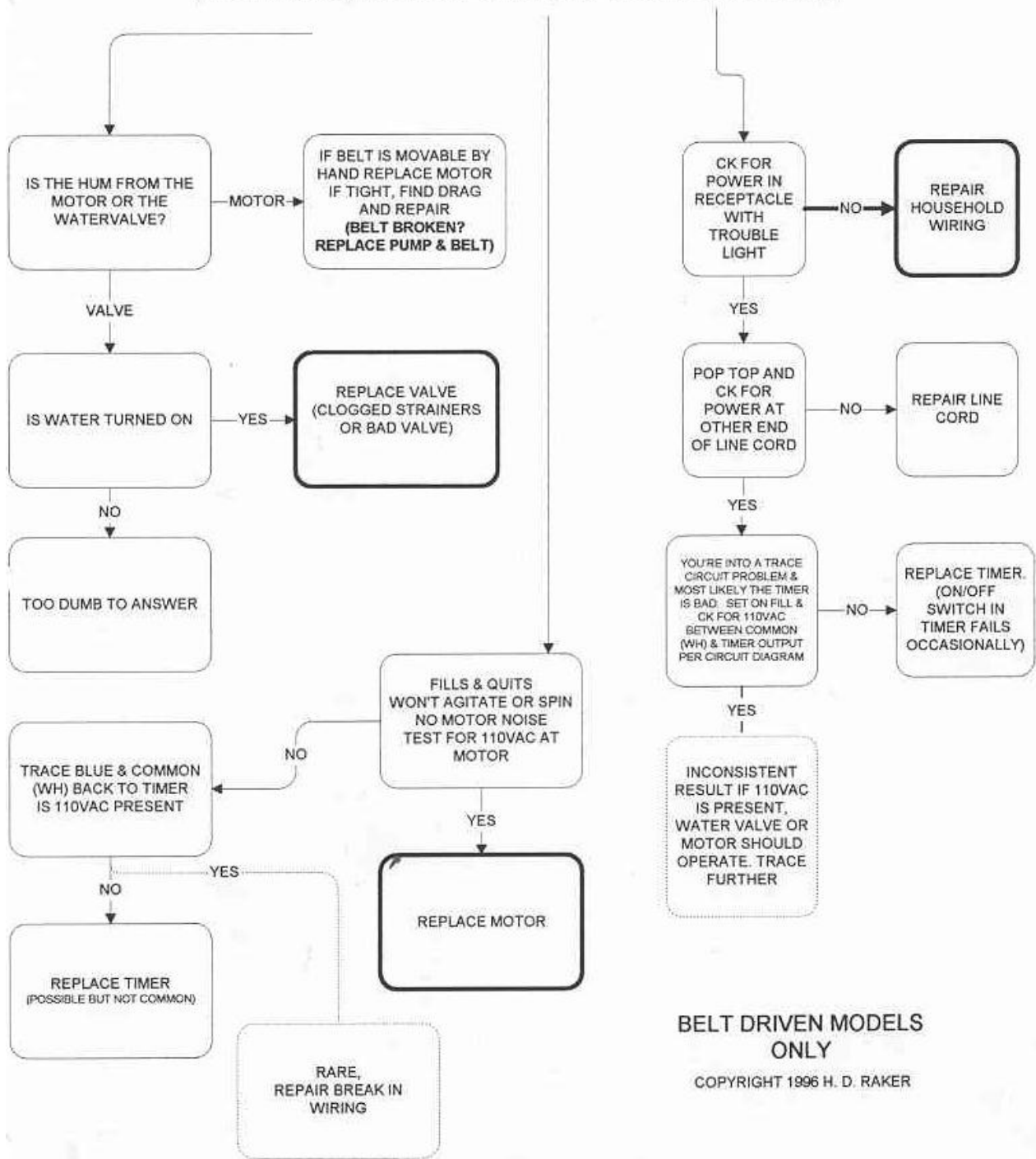
(SPINS FINE)

BELT DRIVEN MODELS ONLY
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KENMORE WASHER WON'T RUN

(ONLY HUMS, FILLS AND QUILTS, OR COMPLETELY DEAD,)



BELT DRIVEN MODELS ONLY

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Whirlpool Washer Won't Drain

With the preceding flowcharts in mind we will study specifics of common problems. Consider the most common of all complaints:

"My washer won't drain."

In real life, few homeowners manually drain out backed up wash water. Instead they call for help. To be an impressive technician and handle this situation, use the following techniques.

A Washer Full of Water

Check out the washer. If it wouldn't drain, it will naturally be partially full of water. Even if the customer was nice enough to bail it out, there will still be an inch left (several gallons) in the bottom.

Rotate the timer to the regular spin cycle and turn it on. Can you hear the motor run? Typically, it will. It may not pump out, but there will still be motor noise. If there is no motor sound, go to the "dead washer flow chart."

Remember to close the lid in order to make the washer spin. There should be motor noise, but no water coming out the drain hose. Next, look at the belt and pump system for a visual check.

Access seems easiest from the rear panel, which is held on by two screws. Most novices bail at this point. (Oh, the back hurts!) They pull the washer out far enough to get into the rear panel and investigate.

Uncle Harry's

Trick of the Trade # 2-1

An alternate and far easier method is to pull the washer out only far enough to tilt it back toward the wall. Put a 1 gallon paint bucket under one of the front legs. This is sufficient height to get your head and light far enough underneath to observe the condition of the belt and the pump.

Most likely, the washer will be well used. The belt will often be worn and probably loose. It runs around a sequence of four pulleys, one of which is a small pump pulley. Most often the pump pulley is frozen, and the belt will be slipping on by. Well, diagnosis in this case is easy, the washer needs a new pump.

This is the bread and butter job of the appliance business - a **Whirlpool pump failure**.

Pump Replacement on a Washer Full of Water

So how do you replace the pump? The factory manuals all assume that the washer is empty, but that's not the real world. Here we are, in the real world.

Uncle Harry's Trick of the Trade # 2-2

Professional technicians rarely bail out washing machines. It wastes valuable time. The repair can be made while the washer is full. (*Uncle Harry* hasn't owned a drain pump for 20 years.)

How is it done? Well, clamp off pliers are the key tool. They are used to pinch pump hoses to stop water from draining and to isolate the pump from the rest of the washing machine.

While the machine is tilted back against the back wall, install clamp off pliers and remove the two bolts holding the pump. Remove the single clamp from the inlet side of the pump, and drop the pump into a plastic dishpan.

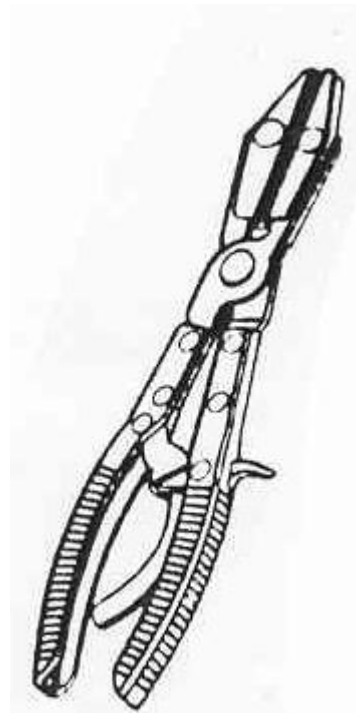
If clamped properly, there will only be a trickle of water coming out of the full tub. Quickly install the new pump. Make sure the belt and the shift arm are both engaged properly, unclamp the hoses, set the washer back up, and pump the water out. Following this procedure pump replacement is a fifteen minute job.

Checking the Belt Tension

Once the new pump is installed, get behind the washer and check the belt tension. If necessary, loosen the closest motor mounting bolt 3/4 turn with a pair of channel locks. Smack the rear motor mount with the same pliers to move the motor back to tighten up the belt.

If the belt has chunks out of it, or is badly worn, it is necessary to replace it.

Clamp-Off Pliers (Fig. 021-04)



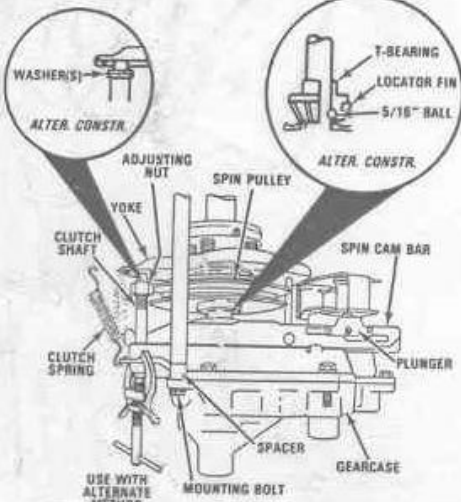
Diagnosis and Replacement of a Bad Belt

Replacing the belt on the Whirlpool washing machine rates an 8 on a scale of 10 in difficulty. It is far more difficult to replace a belt than a pump. Novices have been known to spent 3-4 hours on this job.

A copy of the directions is shown that come with the belt. It looks awesome at first glance, but with practice, it can be done in 20 minutes. After reviewing the sequence here in the official directions, we will study a few of *Uncle Harry's* shortcuts.

Belt Replacement Instructions (Fig. 021-05)

1. DISCONNECT ELECTRICAL SUPPLY AND WATER HOSES.
 2. Lay unit on its front (protect the front of unit from scratches), and remove rear service panel.
 3. Loosen the nuts holding motor mounting bracket, and slide the motor over to the right to relieve tension. Remove the belt from pulleys. Rotate motor to the left as far as possible to assure spin cam bar clearance.
 4. Remove the three (3) support braces attached to the gearcase and baseplate.
 5. Remove the two (2) pump mounting bolts. DO NOT remove pump hoses. If filter is mounted to the gearcase, remove, leaving hoses connected.
 6. While manually lifting up the plunger, rotate the drive pulley (the large pulley on the right-hand side of the gearcase) until spin cam bar advances to the spin position, as shown in Figure 1.



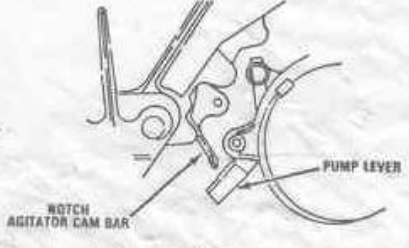
7. Remove clutch spring.
 8. Remove the gearcase mounting bolt which has the spacer. Remove spacer. Loosen the remaining two gearcase mounting bolts approximately seven turns.
 9. The gearcase can now be pulled down so that the belt can be slipped out between the top of the clutch shaft and the clutch yoke, and then through the area where the spacer was removed.
 10. Reinstall by positioning the new belt on the four (4) pulleys, and begin to reassemble. NOTE: A 5/16" steel ball is used with the T-Bearing on later models. Also, in some models the clutch shaft adjusting nut is replaced with washer(s). In both cases, check to make sure these parts are in place before reassembling the gearcase. See Figure 1.
 11. Reinstall spacer and mounting bolt. Tighten all mounting bolts finger-tight only. Next, set the machine upright. Then tighten the three (3) mounting bolts securely. This procedure will allow the superstructure to properly align itself with the centerpost bearing.

12. Lay washer back down and reassemble the support braces, clutch spring and pump, making certain the pump lever is engaged in the notch in the agitator cam bar before securing the pump to the gearcase as shown in Figure 2.
 13. Adjust belt tension and replace rear service panel. (A new, properly adjusted belt will deflect 1/2" when a force of 9-10 lbs. is applied midway between the motor pulley and drive pulley.)

NOTE: ALTERNATE METHOD OF REPLACING DRIVE BELT

A. On machines built before 1971, the clutch shaft can be pushed up by hand to remove spin cam bar.
 B. Machines built after 1971 were built with the "Fast Brake" system that has increased brake spring tension. This prohibits pushing up the clutch shaft to remove the spin cam bar. A car battery terminal puller can be used to push up the clutch shaft, as shown in Figure 1.

1. Perform Steps 1 through 7 in the preceding instructions.
 2. Remove the mounting bolt and spacer.
 3. Push upward on the clutch shaft and, at the same time, pull back on the spin cam bar with a pair of pliers (make sure the plunger has not dropped down into the lower slot in the spin cam bar), so the spin cam bar just clears the clutch shaft. NOTE: Do not disengage the spin cam bar from the slot on the gearcase cover.
 4. The belt can be passed through the gap between the yoke and clutch shaft and then through the area where the spacer was removed. Reverse this procedure to install the new belt. Position the belt on the four (4) pulleys and begin to reassemble.
 5. Push upward on the clutch shaft, making sure it engages with the yoke. NOTE: Make sure the new belt is between the clutch shaft and spin pulley. Also, in some models the clutch shaft adjusting nut is replaced with washer(s). Make sure these washer(s) are in place before reassembly. See Figure 1. At the same time, turn the drive pulley so the spin cam bar goes through the slot in the clutch shaft.
 6. Replace the pump, making certain the pump lever is engaged in the notch in the agitator cam bar before securing the pump as shown in Figure 2.
 7. Reinstall spacer and mounting bolt. Attach the three (3) support braces to the gearcase; tighten bolts.
 8. Adjust belt tension and replace rear service panel. (A new, properly adjusted belt will deflect 1/2" when a force of 9 to 10 lbs. is applied midway between the motor pulley and drive pulley.)



Uncle Harry's
Trick of the Trade # 2-3

The general idea is to drop the transmission about 3/4" to allow freedom for the belt to thread through the clutch pin. That's why all the bolts are loosened. The pump has to be loosened to get the belt inside and past the hoses.

First, the three brackets that steady the transmission are removed and discarded. Except for removing the rear bracket, all the repair work can be done with the machine tilted back against the wall, exactly like it was for a pump replacement.

**Replacing a Whirlpool Pump and Belt
(Fig. 021-06)**



Whirlpool belt replacement needs to be done three or four times before you will feel comfortable doing it. It only requires a 1/2" and 9/16" socket wrench and some practice. *Uncle Harry* recommends that you locate an old Kenmore to use for gaining experience.

A Whirlpool pump and belt job is by far the most common washer repair. **It is probably the most common of all appliance repairs.** As shown in the Flat Rate Guide, it is competitively priced at \$165.00, a **\$150.00 profit!**

With some experience it is possible to walk into a house, replace a pump and belt, and walk out in 40 minutes. The average Mr. Fix-it is completely baffled by this particular repair. Looking underneath, he is totally confused. Typically, he picks up a telephone instead of his tools.

Belt Replacement Pitfalls

There are several things that can go wrong and cause difficulties.

1. Looking from the bottom, you can't see everything, even with a trouble light. Use your fingers to run around the different pulleys to make sure that the belt is threaded properly. It is easy to thread the belt on top of the motor pulley instead of in the right groove.
2. It is possible to completely miss the pump pulley. Also be sure that you get the shift arm underneath the shift bar when installing the new pump.
3. Sometimes it is difficult to get the rear pump bolt started in the transmission casting. If you have difficulty lining up the hole, stick a small screwdriver up into the rear hole to help align before you snug up the front bolt.
4. Do not tighten up the pump bolts with great force. They are threaded into soft aluminum and can be easily stripped.

5. Make sure that the pump inlet side is fully inserted into the hose. Incorrect positioning will make it difficult to line up the mounting holes.

6. While tilting a full machine it may start dribbling water down the back of the washer. Either move fast or bail out a couple inches. Lay down a couple of towels to prevent getting wet.

7 Do not try to test the washer while it's tilted back against the wall. Many models include an off-balance switch that disables a tilted washer. The washer will only buzz. Just tilt it upright before testing.

8. Drain, reposition and test the washer. Of course an empty washer is far easier to move than a full one.

Uncle Harry's

Trick of the Trade # 2-4

When moving any appliance use your knees and lower body to push. Try to minimize any strain on your back. Bump them along with your hips, it is much easier on your body.

9. Always take time to clean the floor and outer surface and **attach a service sticker.** (See Lesson 14, Marketing your Company.)

Wig-Wag Diagnosis and Replacement

Wigwag failure is very common. A review of the “Washer Won’t Agitate” Flow Chart will refresh your memory on the diagnosis sequence. The wigwag assembly fails three ways:

Condition 1. Wiring to the wigwag shears from pivoting.

Condition 2. Coils burn out from age or water.

Condition 3. Plungers rust up or bend from strain.

The most common failure involves the insulated wires that pivot back and forth along with the wig-wag. They break at the twist point and break the circuit to the solenoid. The weaker spot is the left solenoid. The symptom is:

“My washing machine will drain, but it will not spin.”

Uncle Harry's Trick of the Trade # 2-5

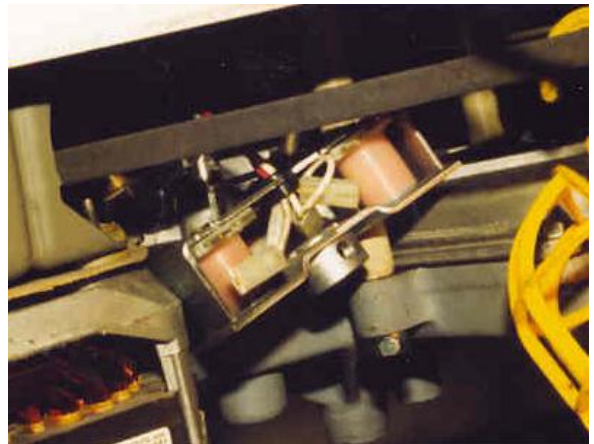
It is easy to remember where the wigwag wires go. “The red is on the left.” It is a political statement!

A second symptom is:

“My washer fills and drains, fills and drains.”

If the washer fills to the top and immediately begins draining down to about 1/2 and then starts filling again, the right hand solenoid is the likely suspect.

Replacing a Wigwag (part # 84867) (Fig. 021-07)



Diagnosis of Bad Wig-Wag Wiring

It is necessary to determine if the fault is in the coil or if there is a problem in the wiring to the coil. To learn the answer, pull the machine out enough to remove the access panel.

Condition 1

Usually the problem will be in one of the three wires coming through the pivot point of the wig-wag. It will have been broken by the constant flexing back and forth.

Uncle Harry's
Trick of the Trade # 2-6

Pull the wires loose and wiggle and tug on them. You should be able to determine which has failed. The break is often hidden under the insulation.

If you are unable to find a visible break in the wiring connect a voltmeter to the two solenoid leads. Run the meter leads underneath the belt so that they won't be ripped off when the belt starts to move. Turn on the washer for a few seconds and observe the voltmeter. If the voltmeter registers 110 VAC and the solenoid doesn't pull in, the coil is bad. This is called a **Live Test** and it is very reliable.

Notice that there is a small spring clip hanging from the sub-frame that supports the trio of wires as they cross the belt and come over to the wig-wag assembly.

Uncle Harry's
Trick of the Trade # 2-7

Replace the piece of bad wire back beyond the spring clip and tuck the splice back up against the wall of the washing machine. In doing so the splice is not flexing back and forth and the repair should last as long as the original.

Be sure to thread the wires back through the clip so that they don't rub against the belt.

Condition 2

If the coil has 110 VAC when it's supposed to and it's not operating, then it needs to be replaced. At first glance, this may look difficult, but as usual, it can be done maybe in fifteen minutes. It requires a 5/16" socket wrench and long extension to remove the tapered pin out of the center of the wig-wag. Wiggle the loose wigwag back and forth on the pivot shaft and gradually work it up until it comes off.

Condition 3

If either cross pin in the wig-wag is broken, the solenoid will pull in and the machine will not agitate or spin as expected. More problems can be expected on the spin side.

Occasionally, a cross pin or plunger bends. This job is a bit more difficult than replacing the entire wigwag because the pins are hardened steel and are nasty to cut off.

A pair of diagonal cutters is useless for the task. A single-ended hacksaw blade is the best tool for the job. (A hacksaw blade held securely in a rag will work fine.) Hold one end of the pin with cutters and saw off the other. Once the pin has been removed, it's easy to put a new one back in. New ones have a little slip nut for the new pin. Even though it takes a little time, install the provided plastic guides.

Damaged Wigwag Plunger and Cambar (The upper plunger is damaged) (Fig. 021-08)



Be sure to inspect the cam bars. Make sure that they slide easily and are not bent or rusted. Check the cam bar retaining spring on top of the transmission. It squeezes the cam bars down, and provides a smooth shift.

On re-installation of a new wig-wag, it's imperative that the three wires come through the center hole and move a minimum amount. A new wigwag comes with a black plastic ring that must be snapped in place to steady the wires.

Uncle Harry's

Trick of the Trade # 2-8

A loud **clunk** heard during the spin shift indicates a broken cam bar hold down spring or a rusted shift pin.

Diagnosing and Repairing Water Leaks -

There are six reasons for water leaks. They are:

1. A leaking main tub seal donut.
2. A rusted outer tub bolt.
3. A cracked outer tub.
4. A loose bleach dispenser hose.
5. A leaking water pump.
6. A leaking hose connector.

Careful visual inspection will always find the source. Inspection requires opening the top of the cabinet. A screwdriver carefully jammed between the top and the main cabinet will free the hold down clips and allow the top and console to be folded back. With the top raised and the washer running most leaks can be quickly spotted. The paint can technique mentioned during pump replacement is also effective.

Caution, don't be fooled. In some circumstances, water will drip onto the pump from above and trick you into thinking the pump is leaking. Take a good look to make sure that there's no water dripping from the sub-frame onto the pump.

Uncle Harry's

Trick of the Trade # 2-9

Reach up and feel the top of the pump and check your fingers for wetness. If the pulley is wet the water is coming from somewhere above.

**Cabinet Top After Opening
(Fig. 021-09)**



Locating a Leak Source

It is common for water to drip off the center of the back of the sub-frame. Often the problem will only appear when the machine is full and sometimes it even needs to shake with clothes in it. At levels of two or three inches, the leak may not appear.

If the leak is hard to find, fill the washer to maximum, put in heavy clothes, all to one side and let it shake. If there is a hairline crack somewhere, running an off-balance load will usually reveal the drip. A telltale clue will be dried soap stains and corrosion in the middle of the sub-frame and below it on the cabinet base.

Sometimes a small leak goes on for many months before it gets bad enough to notice.

Repairing the Outer Tub (Conditions 1-3)

Many manuals advise replacement of a leaking or cracked outer tub. This expense can usually be avoided. In the exploded views, review the construction of the outer tub. The center post that drives the clothes basket and the agitator shaft come through a 3" hole in the bottom, sealed by a doughnut shaped gasket. The outer tub is held down by four bolts sealed by rubber washers squeezing it against the sub-frame.

There are three reasons for lower outer tub leaks.

1. The doughnut seal fails from vibration and being under water for many years. Water will dribble through the center, run along the sub-frame and drip off the back.
2. A hole rots through the steel adjacent to one of the mounting bolts where the porcelain has cracked.
3. Sometimes a pin or some foreign metal object will lodge in the outer tub and gradually wear a hole through the porcelain and result in a pinhole. Any flaw in the porcelain allows water to rust through the thin steel behind.

Without pulling the tub, it is difficult to tell which of these three is the source. However diagnosis and the charge is still the same (See Flat Rate Manual). :The parts cost is incidental to the labor.

"Mrs. Jones, You have a leaking outer tub. To disassemble the washer and repair it will cost \$165.00."

The repair procedure is as follows:

1. Fold the cabinet top back.
2. Remove the snubber arm and the clips that hold the top of the outer tub in place.
3. Either fold the top tub cover to the side or remove the fill hose and set the top aside.

4. Remove the agitator. The agitator is held on in several ways, but usually by a 7/16" bolt underneath the cap.

5. Pull the agitator off and remove the "spanner nut" holding the clothes basket.

Uncle Harry's
Trick of the Trade # 2-10

Although it beats up the spanner nut, a metal chisel can be used in place of a spanner wrench. A professional uses a Whirlpool tool (part # 12393)

Once the spanner nut is off, lift off the clothes basket. In some cases ,it is rusted in place.

Basket Nut and Wrench
(Fig. 021-10)

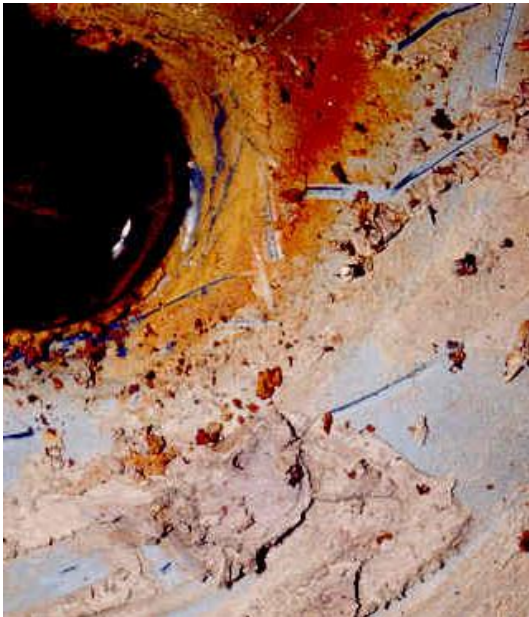


Uncle Harry's
Trick of the Trade # 2-11

Grab one side of the basket with both hands and quickly push it up and down. Act like you are trying to break it. This will break loose the corrosion in the center of the basket and then you can lift it out.

Use several large rags to wipe the sludge from the bottom. Clean the center post and evaluate the situation.

A Muddy Outer Tub
(Fig. 021-11)



Uncle Harry's
Trick of the Trade # 2-12

If you carefully dry the inside of the outer tub before removal, so that no water spills, the water pattern on the outside of outer tub, will direct you right to the leak.

1. Knock the tub block loose with a hammer. Use a sharp tool and sand paper to completely clean the center post. The outer tub seal must slide up the post for removal.

2. Proceed with the removal of the four outer tub bolts. Remove the pressure switch hose on the right-hand rear side and the bleach dispenser hose (if the model has one). Pull the whole outer tub up and off the sub-frame. Wiggle it up the center post and turn it upside down on the floor for inspection. (Total time expended at this point on an average washer should be twenty minutes).

With the outer tub upside down on the floor, inspect it and the sub-frame for water stains.

Inspecting for Water and Water Stains

The stains will indicate if tub bolts are bad or whether the doughnut seal is bad. Replace the tub seal and any suspect tub bolts. The tub seal can be easily pushed out with a screwdriver. Seal the new one with glue before sliding it into place. (It is a challenge to install without getting glue on your fingers.)

To compensate for any holes near the tub mounts, Whirlpool provides a kit with oversized washers and rubber seals (part #76673).

Holes found away from the mountings can be repaired with a patch and waterproof glue.. A patch can be made from any piece of rubber and MMM glue # 847 works fine. Before attempting to glue it, be sure to clean the hole carefully.

Inspecting for Water and Water Stains (Fig. 02-12)



Uncle Harry's

Trick of the Trade # 2-13

Instead of waiting for 20 minutes while the glue sets, use a hair dryer. Heat up the repair with hot air until the glue sets and then re-assemble the tub. (MMM glue bubbles and pops when heated, but eventually forms a great seal.

The center post should be clean and dry before reassembly. A rusted ring at the bottom is harmless. The new doughnut should seal anyway. A ring of MMM around the base of the post is good insurance that the new seal will seat. A second bead at the water outlet is also advised.

≥ Take care not to break the air dome off as you push the outer tub back in place. The tub will seat itself, just twist it until the holes line up. Seal each one of the four holes with glue and tighten everything down. Continue with re-assembly.

If done as described, this repair holds up well and is a popular money maker. It is a difficult job and takes a little bit longer than some repairs, about a 45 minutes from start to finish. The high profit makes it worthwhile.

**Oversize Washer and Seal
Plus Sample Installation
(Fig. 021-13a)**



(Fig. 021-13b
)



Leaking Bleach Dispenser Hose (Condition 4)

Liquid bleach enters the outer tub through a rubber hose connected the front right corner. Vibration and age will break the seal between the rubber and tub. Careful observation will locate this leak. Although room is at a premium the connection can be sealed without removing the outer tub. Once the area is carefully dried ample MMM glue and heat will form a good seal.

Leaking Pump (Condition 5)

Pump replace and diagnosis is covered fully under “Whirlpool Won’t Drain.” in another section.

A Leaking Hose Connector (Condition 6)

Leaks commonly occur at the rear plastic fitting that couples the water pump hose through the back of the washing machine case to the drain hose. It wobbles, wears a hole on one side, and leak. Replacement is simple.

Leaking Plastic Connector (Fig. 021-14)



Off-balance problems

Except for the two rear feet, Whirlpool washers seldom have any suspension system problems. The two back feet are interlocked with a sliding bar linkage. If one goes up, the other is forced down. Consequently, a floor can be out of level, as much as an inch, and the washing machine will not rock. The back legs automatically compensate.

When a machine is over 5 years old, the linkage bars in the back may get rusty and stick. A customer may complain:

“My washer is shaking all over the place.”

Uncle Harry's

Trick of the Trade # 2-14

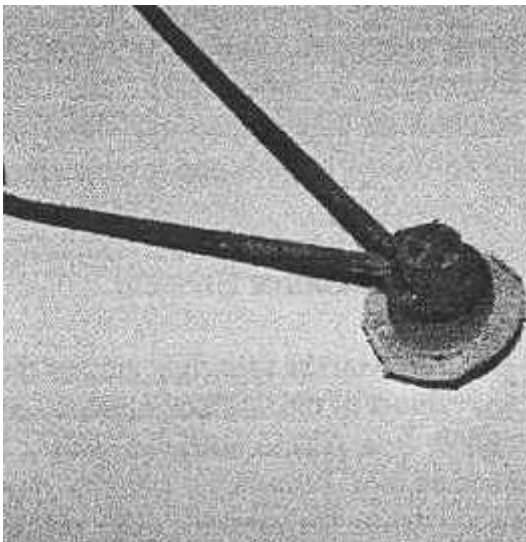
Grab the console and tilt the whole machine forward about a foot and let go of it. Let it bang back on the rear legs. This will usually break loose any rust and level the legs so that the machine won't rock any more.

The Snubber

The top seal of the wash tub is pressed downward with a wedge-shaped spring that presses against a plastic disc that is turned and squeezed down on the top of the tub.

This snubber, aptly named, minimizes the shaking motion of the washing machine when it spins. The snubber is the equivalent to the shock absorber in an automobile. The snubber rides against a plate fixed to the top of the wash tub. When it gets old, soap particles can build up underneath it.

Worn Snubber (Fig. 022-15)



Three things can happen:

1. It becomes slippery and won't snub any more. This is repaired easily by lifting up the spring and snapping out the snubber disc and cleaning it with sandpaper to get the accumulation of dirt off. Clean the plate that it rides on and snap it back together.
2. It also will occasionally make squeaking noises when it moves back and forth due to a buildup of soap. Again cleaning is effective.
3. Occasionally, a snubber actually wears out and needs replacing.

The Suspension System

The basket suspension system on Whirlpool is something to ignore.

Uncle Harry's

Trick of the Trade # 2-15

In working on thousands of them over 30 years, the only time I've ever seen a suspension system apart was when a **homeowner shouldn't have and took it apart**. It's extremely reliable and trouble-free.

The Off-Balance Switch

Located on the rear right side of the outer cabinet of the washing machine (on some models) is an off-balance mechanism. It is a buzzer and a switch. When the machine goes off balance, it shuts the machine down and buzzes. The buzzer and switch reset when the machine is turned off and turned back on.

Occasionally, a dead machine is caused by a burned out wire on the off-balance switch. The main power to the timer goes through the switch. It is easy enough to install a new one. However, if you wish to save a second trip, there is an alternative:

Uncle Harry's

Trick of the Trade # 2-16

The off-balance switch can be permanently bypassed by splicing the two switch wires together. Tape those wires against the cabinet and throw away the burned out switch. When modified this way, the washer will knock when off-balance instead of shutting off.

Most customers don't care about the off-balance switch, particularly if you tell them that you have saved them money by bypassing it.

The Lid Switch

The lid switch is operated when the lid is closed allowing the washer to spin. In older Whirlpools, the switch was hidden in the hinge and was a mercury operated device. Mercury floated around in a little glass capsule and shorted two wires together when the lid was closed.

Recent Whirlpools have a stud about the size of a nail that is clipped into the lid. The stud penetrates the top of the washing machine and pushes against a micro-switch. The switch and switch arm may be broken by an off-balance load. The little stud also breaks off.

Testing a Lid Switch (Fig. 022-17)



The simplest lid switch tester is a small screwdriver. Press down through the hole where the stud goes and push against the lid switch. If there is an audible click when the screwdriver is inserted, there is a high probability that the switch is fine. If there is no click or if there is no arm beneath the screwdriver, raise the top of the washer and look further for visible damage. Many times the parts are simply broken and need replacement.

Uncle Harry's

Trick of the Trade # 2-17

Without the proper parts, it might be tempting to bypass the lid switch and connect the two wires together. **Don't ever do it. A bypassed lid switch can lead to a major liability problem.** If someone (perhaps a child) grabs at the clothes while the machine is spinning serious bodily harm could result.

The Console

The console controls includes a water level control, a water temperature switch and a timer.

Water Level Controls

The water level control is seldom a source of service calls. Water level problems are almost always a result of the water valve failure rather than the water level control. However, problems do occur in the air line connected to the control.

The water level control is a small micro-switch, mounted against a diaphragm. The diaphragm flexes depending on the water level in the washing machine. It senses slight changes in air pressure coming up a small plastic tube that is connected down low on the side of the wash tub. The tube is connected to an air dome mounted on the side of the tub.

Typical Console (Fig. 022-18)



Problems With Water Level Controls

1. Clogs occur in the air dome.
2. The plastic tube may pull off the air dome.
3. There may be a kink or a hole in the air tube.
4. Also the water level switch can inadvertently be turned all the way to the reset position and cause an overflow.

Typical Airdome and Air Line (Fig. 022-19)



Any of these four conditions can cause overflowing. Careful visual inspection is necessary. A clog in the air dome itself can be difficult to diagnose without removing it from the outer tub. On direct-drive Whirlpool models this requires removal of the clothes basket.

Uncle Harry's

Trick of the Trade #2-18

A water level control can be tested by simply gently blowing air into the air line with your mouth. If the control clicks full and then empty, the control is operational and the problem is in the air signal.

Water Temperature Switch

Similarly a water temperature switch rarely ever fails. It is subject to very light duty switching power from one side of the water valve to the other. However, a customer may not fully depress the selector switch or set it in between choices. Some switches have dead spots in between selections. This is particularly true of the push-button type (Maytag in particular). If no selection is fully depressed, water will not come in.

The Timer

The timer is by far the most important console component. Most Whirlpool timers are the quick disconnect type and are very easy to change. However, timer failure can be a difficult thing to diagnosis.

There are three types of timer failures:

1. The most common failure is a dead spot. The usual Whirlpool dead stop is right at the end of the wash cycle at the beginning of the rinse cycle. The machine will reach that point and stop dead. It can be easily misdiagnosed as a bad water valve (See water valve diagnosis in Lesson 1).

“My washer stops in mid-cycle, but if I move it one click it finishes fine.”

Be sure to check the water valve at other timer positions before concluding that the problem is a bad timer. It is best to set the temperature control at warm wash and warm rinse to make sure that the machine doesn't come out of that pause position.

Uncle Harry's

Trick of the Trade # 2-19

Jiggle the timer knob a little bit in the dead spot and if the washer begins to function, you know the timer has a bad contact.

1. The timer won't advance at all.

“My timer won't go through the cycles unless I push it along.”

This is a failure of the timer motor or escapement (as described in Lesson 1) and requires a new timer.

2. Non-functioning cycles:

If the washer works fine on one cycle and not another, it usually is a timer failure. However many models have two or even three speed motors. A bad motor winding may appear as a timer failure. For instance a motor that is faulty only on gentle speed would seem to be a timer failure on the gentle cycle.

A voltage test at the motor itself will complete the diagnosis. No power at the motor will confirm a bad timer. Avoid trying to diagnose a timer by putting your voltmeter into the timer connections. It is difficult and is not advised. A live test for power after it leaves the timer is much more reliable.

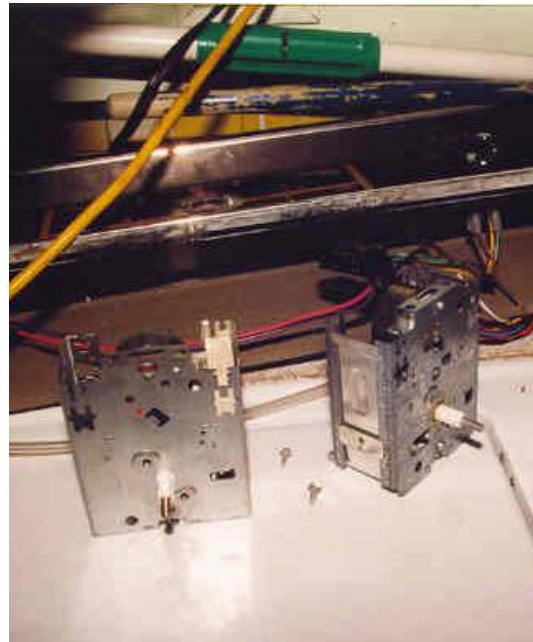
3. Timer knobs frequently break off on Kenmore washers. They are easily replaced and are a simple service call.

Changing a Timer

A timer replacement includes:

1. Opening the console
2. Removing the timer knob by turning it backwards.
3. Removing the screws hidden behind the knob and pointer.
4. Unplugging the connector to the timer. (Follow any special instructions that may come with the new timer.)
5. Reassemble and test the operation.

Changing a Timer (Fig. 022-20)



The Transmission:

Whirlpool transmissions typically outlast the rest of the washer unless they are damaged by a water leak.

The transmission functions in the following way: First the spin and braking mechanism of the clothes basket are mounted on top of the transmission. They look like part of the transmission but are a totally separate function.

The transmission is driven by the large 6" pulley. The gears inside are running whenever that the motor is running. The agitator shaft (the transmission output) is engaged and disengaged by a pin that is raised and lowered by the agitate cam bar. The small pin slides up and down whenever the right hand cam bar is switched from wash to drain. The pin position is determined by a ramp on the cam bar.

Whirlpool Transmission (Fig. 022-21)



Transmission Failure

Whirlpool transmissions fail in the following ways:

1. The transmission pulley may come loose from the transmission drive shaft and damage the drive shaft and the pulley. The pulley will wobble around make a lot of noise and eventually throw the belt off. Replacing the pulley alone, after cleaning up the drive shaft is usually sufficient.
2. Water leaking down the agitator shaft or spin tube will collect inside the transmission. It will float out the transmission oil and cause the inside to rust up and seize. It is not unusual to find transmission oil covering the top of the transmission.

Uncle Harry's

Trick of the Trade # 2-20

A mixture of water and oil that looks like mud is often found splattered in rings all over the inside of the outer cabinet. It is thrown out by the spinning pulleys. A small amount is harmless. However, a large pattern indicates serious bearing wear and brewing trouble.

Reasons for Transmission Removal

1. Failed transmission gears.
2. A broken cambar spring.
3. A bent or damaged cambar
4. A bad basket drive assembly.
4. Bad main bearings and seals.

Whirlpool Transmission with Wig-Wag and Cam Bars (Fig. 022-22)



Transmission Replacement

Believe it or not transmission replacement is relatively easy. It requires the following steps:

1. From the top, remove the agitator and lay the machine forward.
2. Remove the transmission brackets and the three transmission bolts. Remove the two pump bolts.
3. Slide the belt off, and push the pump to the side. Remove the clutch pin and clip.
4. Disconnect the wig-wag wires and the transmission will slide right out the bottom of the machine.

A technician can remove a transmission in about 20 minutes. Transmissions are frequently sold on an exchange basis. Return the old one for re-building at the factory. With the transmission out of the machine, only the spin clutch assembly remains up in the bottom of the sub-frame.

Basket Drive System

Removal of the agitator, clothes basket and the tub block provides access to the top segment of the spin tube assembly. Removal of the transmission just covered provides access to the bottom. The basket drive is a chrome plated steel tube that sticks out about 2-1/2" from the main center tube of the sub frame. It is possible to remove the transmission and basket drive together as a unit.

Remember back when we talked about pulling the outer tub out of the washing machine and we knocked the tub block loose with a hammer. If the tub block is loose and the agitator is off, it is possible to pull the spin clutch assembly out while it's still on top of the transmission. It will come out as one whole unit. The spin tube performs two major functions:

1. A braking function that holds the basket still when the machine is in agitate. Braking also rapidly stops the basket from spinning when the lid is lifted,
2. A clutch function that allows the heavily loaded basket to gradually come up to full spin speed as the water is pumped out.

The basket drive is nestled between the sub-frame and the transmission top. To review, the spin cam bar is on the left side of the transmission. It is operated by the red-wired solenoid and raises and lowers a pin at the far end of the spin cam bar. This pin engages and disengages the spin clutch assembly. It actually raises and lowers the whole basket of clothes slightly when it functions.

Atop the spin assembly is a large disc of Masonite material that operates as a brake shoe and squeezes against the bottom of the sub-frame and brakes. Three little nickel-sized spring loaded discs comprise the clutch. They slowly bring the basket up to speed.

Uncle Harry's

Trick of the Trade # 2-20

A good clutch should be able to pull loose from a wet hand dragging on the inside of the basket. A dry hand on a dry basket should stop it. Be wary of any obstruction jammed between the inner and outer tub.
(I once found a chess pawn in between.)

Failure of the Basket Drive Assembly

An older machine may wear out the nickel-sized clutch discs. Such wear can usually be found by visual inspection. A basket drive failure is indicated by no spinning or only slow spinning. A faulty spin assembly will not transmit enough torque to spin a heavy basket of clothes

up to full speed. A marginal one will work on light but not on heavy loads.

If the entire basket spins easily by hand, while the clutch is lowered and it won't spin on it's own, the basket drive is bad.

Basket Drive Assembly (Fig. 022-23)

BASKET DRIVE/BRAKE			
Part No.	L	Spring Color	Belt/Transmission
383922	18-1/2"	Red	96388/365014 Std.
383923	18-1/2"	Red	95405/365012 (350524)
383924	18-1/2"	Blue	96388/365712 Port
383925	18-1/2"	Green	95405/366660 Large
383926	18-1/2"	Gray	356402/367551 Port
383927	18-1/2"	Green	96388/367593 Large
383929	13-1/4"	Green	95405/357972 Large
383930	13-1/4"	Orange	95405/358365 Std.
383932		Gray	356402/Compact
383933	13-1/4"	Red	95405/Standard Mod.
383937	21-1/2"	Green	96388/365011 Large
383938	21-1/2"	Green	95405/365359 (350550)



Main Bearing and Basket Drive Failure (An Overhaul)

The spin assembly is a long tube that acts like a drive shaft with an upper and lower bearing to hold it steady. On older machines, the bearings wear out and gradually cut holes into the steel spin tube. The washer will knock in the spin cycle as the basket wobbles back and forth on its axis.

This is a major overhaul and requires pulling the transmission and spin tube assembly out the bottom. Proper repair requires that the main bearings, seals, and the basket drive all be replaced. Even without replacing the bearings and seals, a basket drive replacement will take between one and one and a half hours. Replacing the seals and bearings will add another half an hour. They need to be driven out the top and bottom. Replacement requires either a bearing puller or carefully driving them back in by hand.

Uncle Harry's

Trick of the Trade # 2-21

An overhaul is not a recommended job, but if you are tempted, here are a few hints. Use an old bearing as a drive block on the new bearing. Don't bother with the bottom bearing and seal. The machine will run fine without it or with the old one left behind.

Be careful that when the new spin tube is slipped up into the bearings that it turns freely. The basket cannot have any drag whatever or it will not turn up to full speed when the clutch is engaged.

Considering the time involved (2-3 hours) an overhaul must be priced around \$300.00. Since few home owners are willing to pay that much, an overhaul is rare.

Occasionally when a machine is older and heavily loaded, it will make a terrific vibrating noise on the spin. This noise is caused by wear in the main bearings. The extra play will set up a vibration in the clothes basket. It can vibrate badly enough to make the machine walk across the floor. Except for the unusual noise, it acts like an unbalanced load. This failure happens rarely and can be a difficult problem to diagnose and easily confused with an off-balanced load.

A customer's description of the level of noise gives the best clue. To reproduce the noise, load rugs or jeans on one side, wet them and put it in the spin cycle.

The Agitator:

Most agitators on Whirlpool's are driven by a splined agitator shaft.

On very old models the shaft is keyed. If a customer overloads the machine or if the drive splines have become corroded, it is possible for the metal spline to rip out the matching plastic spline inside the agitator.

Uncle Harry's
Trick of the Trade # 2-22

Look for the agitator cap moving back and forth without the agitator moving.

An agitator replacement should be priced carefully; different models have drastically different costs.

Basket Drive Block (Fig. 022-24)



Basket Drive Block:

A basket drive block, has two notches that mate with the small raised portions on the basket drive assembly.

These ears can be torn off by an overload. The washer may not spin even though the clutch is engaging and trying. The basket may be loose on the basket drive shaft. The top of the basket block can be visually inspected by removing the agitator. A new block will usually cure the problem. It may be necessary to file and sharpen up the ends to the basket drive shaft so that it won't tear up a new drive block.

If the basket drive block fails, the entire basket may drop down and rub against the outer tub. The failure may seem to be a bad clutch, when in fact the tub is dragging. Listen for a scraping noise during spin.

Conclusion:

We have now covered all problem areas of belt-driven Whirlpool washers. Many of these ideas and procedures will be referred to for comparison with other designs. The next model is the Whirlpool direct-drive.

Whirlpool Washer- Direct- Drive Design:

The direct drive Whirlpool is a completely re-designed automatic washer. Some of the concepts are similar to the older belt-driven, but most are new. Externally, it appears very similar; however, looks are deceiving. The most interesting feature is the cabinet. By simply flipping back the console, removing two clips and two screws, the complete cabinet comes off to expose the entire basket and drive mechanism.

A direct drive washer is actually easier to diagnose and repair than the belt-driven design.

Compared to the belt-driven, the direct-drive model has eliminated a great number of parts. The entire wig-wag was eliminated by using a reversing motor and different transmission design. The suspension system is completely changed.

The Drive System Overview

Remember the complicated transmission on the belt-driven Whirlpool, with all the cam bars and pins? By comparison, the direct-drive is a compact, lightweight design. When the motor is rotating in one direction, the output agitator shaft oscillates back and forth. On reversal, first the transmission sits idle, and then after a timer pause, shifts into spin.

The basket drive is similar in theory to the belt-driven design. It is simpler and more easily replaced or even field rebuilt. Like the older design, it is sandwiched between the transmission and sub frame.

The pump is a very simple two-hose design much like many other brands. When the motor is in the wash cycle the pump tries to suck from the drain hose. During spin, it sucks from the wash tub and pumps out through the drain hose.

Cabinet Removal on a Direct-Drive (Fig. 022-25)



**Flipping the Console and
Removing the Cabinet Clips**

(Fig. 022-25)



The sequence of the operation

Again, to understand the way the components interact, it is informative to go through a sequence of operation.

1. As with all automatic washers, when the machine is in the agitate cycle, it begins to fill while the motor and drive system sits idle.
2. Once the washer is full of water and has satisfied the water level switch, the motor starts and **simultaneously agitation begins.**
3. The washer agitates until the timer reaches the end of the wash cycle.

This is where the direct-drive differs from the belt-drive.

4. **At the end of the wash cycle the motor pauses and then reverses. Reversal begins the drain cycle and sets a linkage inside the transmission. The transmission idles until partly into spin when the timer pauses the motor again.**

5. **The pause during the spin cycle locks the transmission linkage into the basket drive, and on motor start-up spin begins.**

(Note, if you lift the lid on a direct-drive Kenmore, the motor will stop and the machine goes dead.)

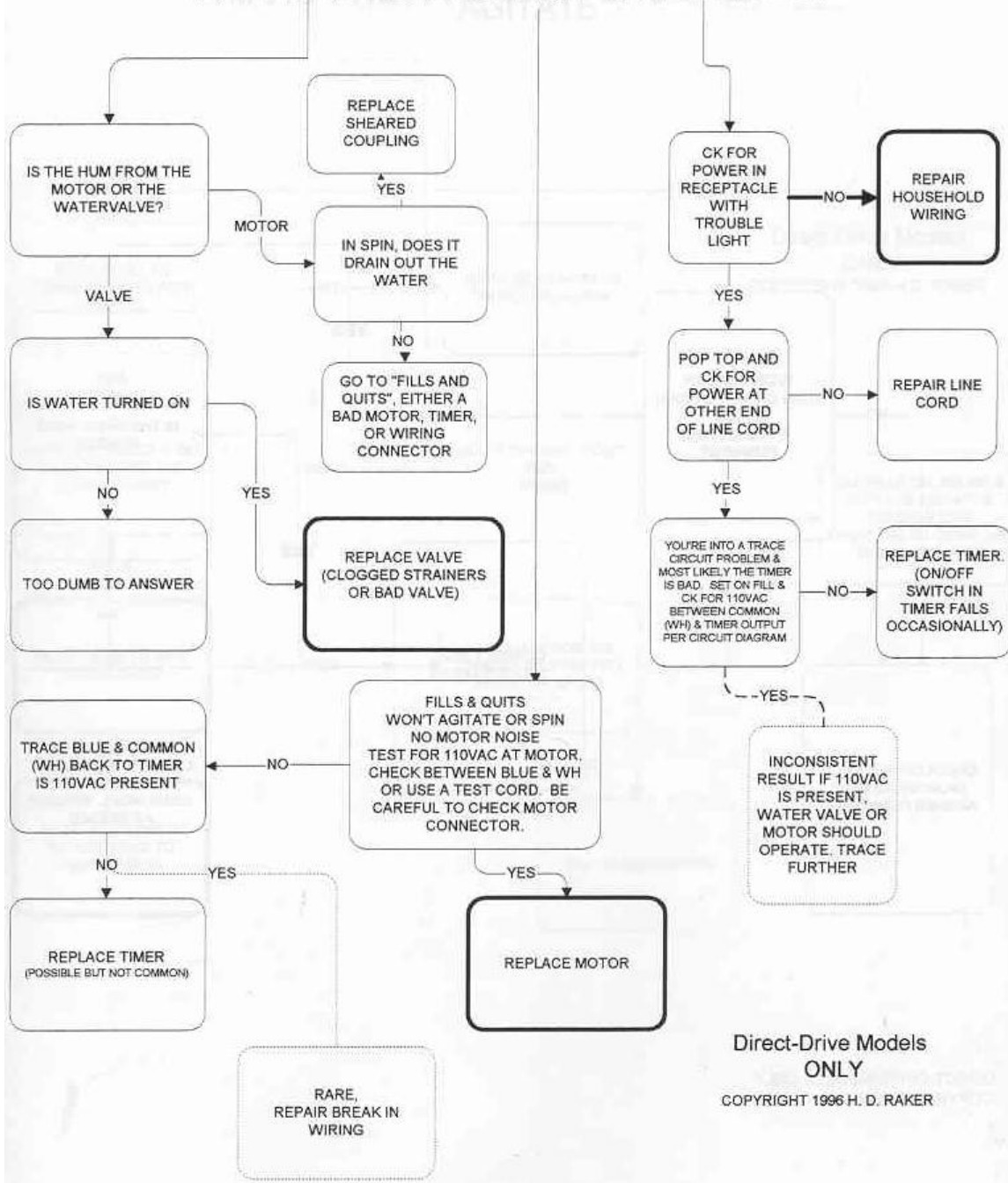
Gradually the RPM increases and the water gets drained out. As the speed of the basket increases, more and more water is squeezed out of the clothes. It goes down into the pump system and is drained into the sink.

The same sequence repeats for the rinse cycle and then a long spin. Direct-drive models include a spray rinse like belt-driven ones. It is activated for short periods of about 15 seconds during the spin.

Following are direct-drive flow charts and an exploded view. The flow charts are all organized with the most common problems highlighted indicating the highest priority.

KENMORE WASHER WON'T RUN

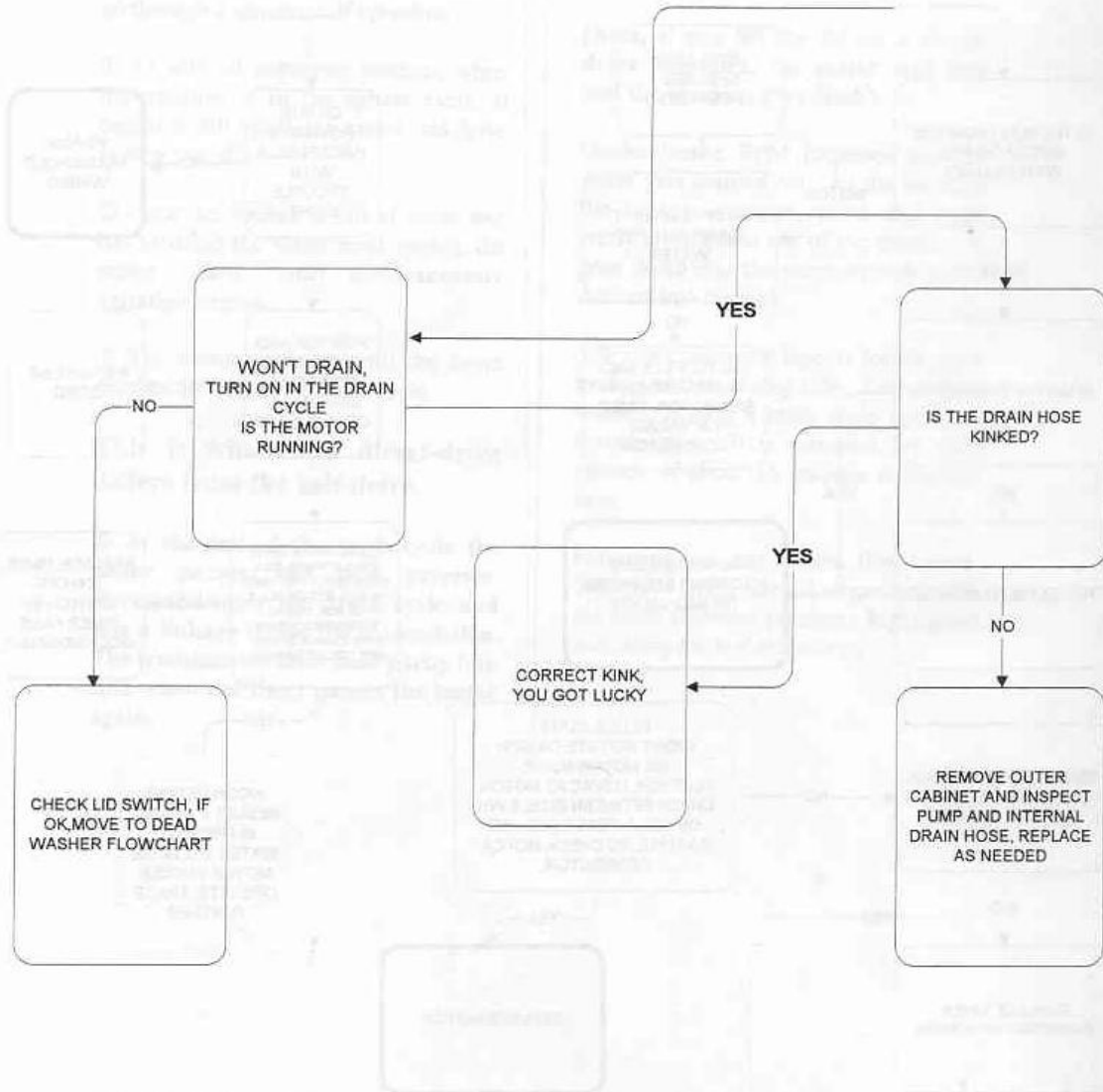
SET ON REGULAR CYCLE (IN AGITATE) FOR TESTS
(ONLY HUMS, FILLS AND QUILTS, OR COMPLETELY DEAD,)



Direct-Drive Models
ONLY

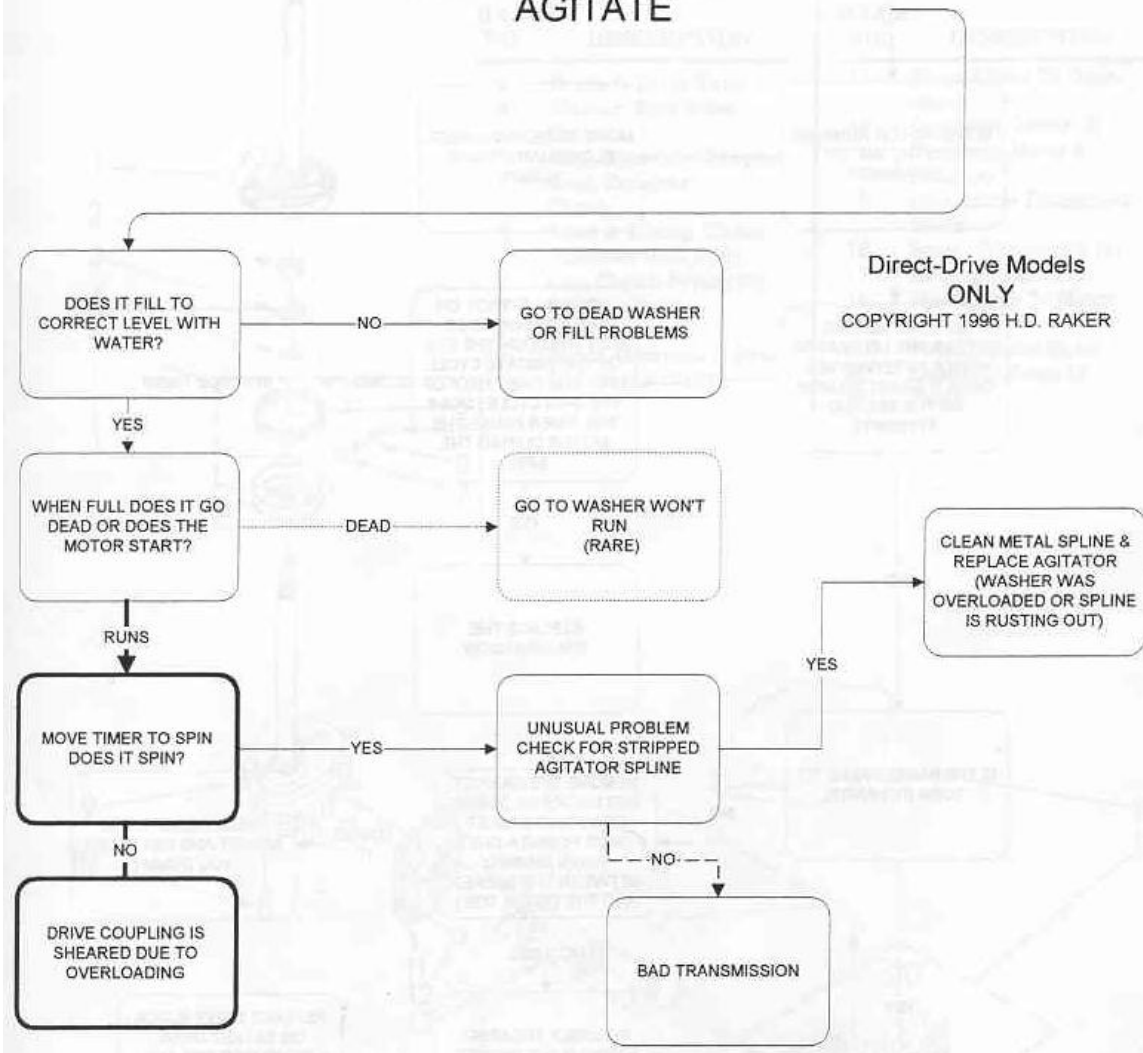
COPYRIGHT 1996 H. D. RAKER

KENMORE WASHER WON'T DRAIN



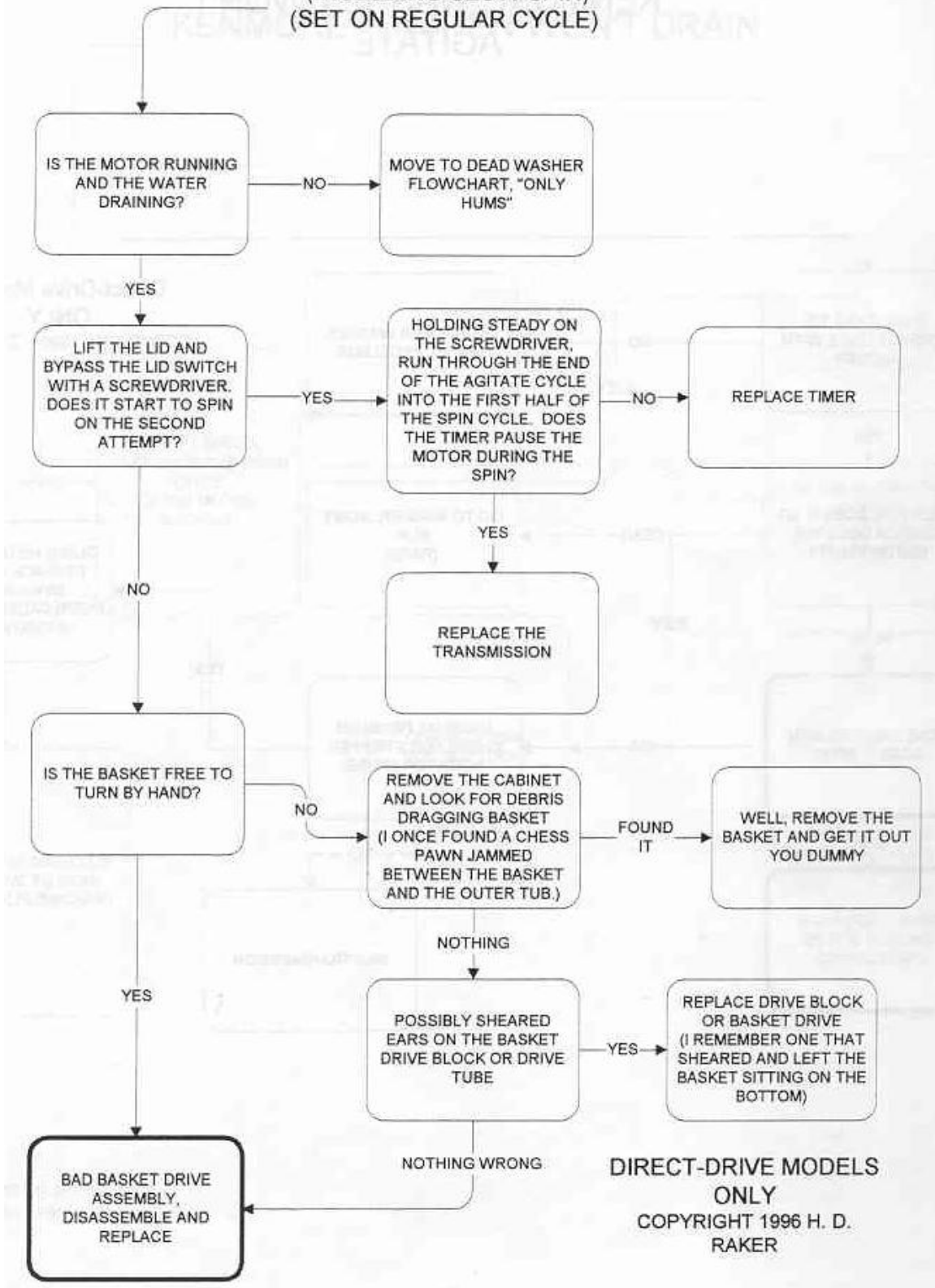
DIRECT-DRIVE MODELS ONLY
COPYRIGHT 1996 H.D. RAKER

KENMORE WASHER WON'T AGITATE



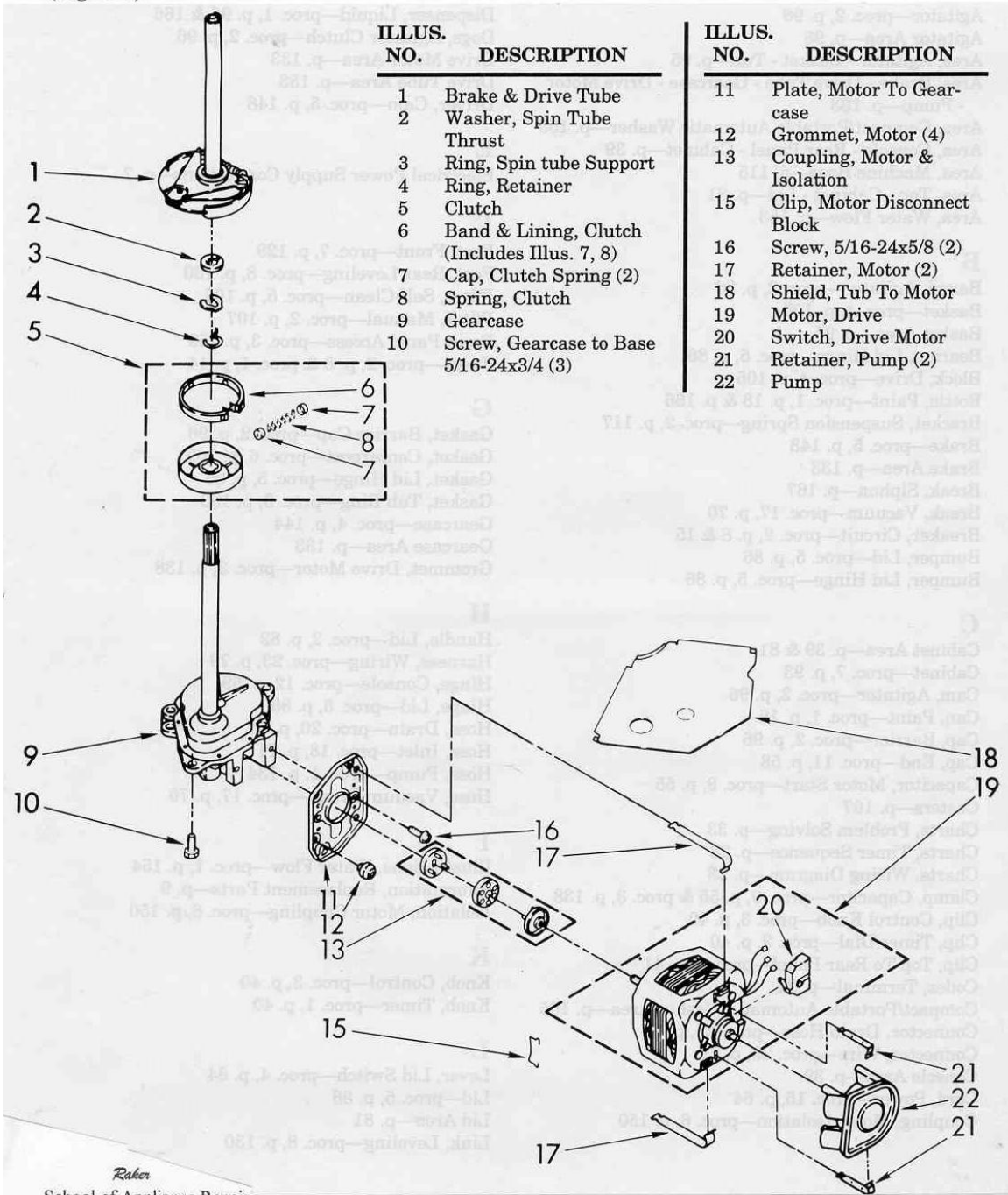
KENMORE WASHER WON'T SPIN

(INCLUDING SLOW SPIN)
(SET ON REGULAR CYCLE)



**Exploded View
(Fig 022-26)**

Exploded View
(Fig 2-26)



Direct-Drive Components

The direct-drive washer was phased in between 1984 and 1988, so some failure patterns are just beginning to appear. However, it does have some obvious weak spots.

Motor Coupling

(# 13 on the drive-drive exploded view.)

The motor is directly coupled to the transmission by a rubber and plastic coupling that shears if the washer is overloaded. In order to replace it, the pump and motor need to be removed. The pump need not be completely removed, only pushed aside. Both the pump and motor are held on by simple snap clips. The coupling must be carefully aligned when re-installed. Be careful that the coupling pins line up when the motor is re-installed.

Diagnosis of a torn coupling is fairly simple. The motor will run during both agitate and spin. The washer will fill and drain, but neither the basket nor the agitator will move.

Uncle Harry's

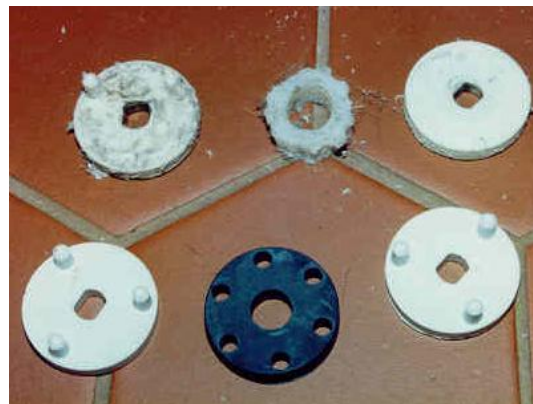
Trick of the Trade # 2-23

If the pump **still drains** and the washer will not agitate or spin, it's sure to be a bad coupling.

Another clue to a bad or damaged coupling is noise and vibration in both wash and spin.

Sample Motor Couplings

(Fig. 022-27)



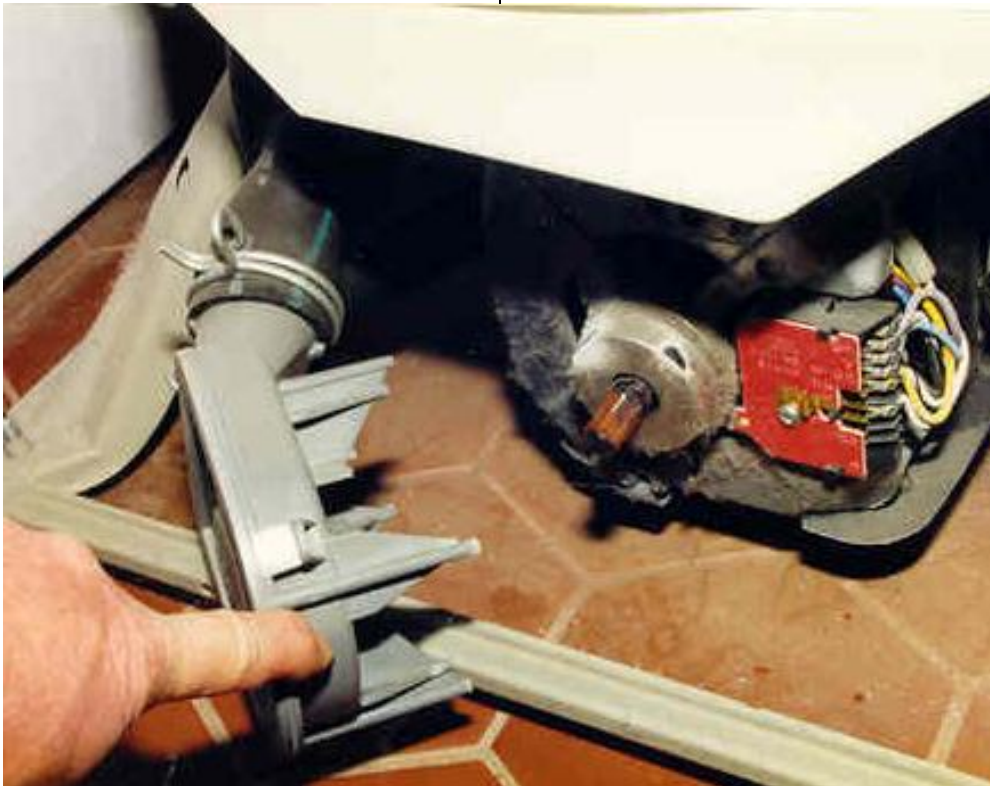
The Water Pump

The direct-drive pump is a simple two-hose one that can be replaced with just a screwdriver. It couples on the end of the motor shaft with two snap clips. It couldn't be any easier to replace. One

pair of clamping pliers allows for replacement on a washer full of water.

The pump leaks at the drive shaft and at the factory seals. Leaks are easy to find once the cabinet is off.

Direct-Drive Pump (Fig. 022-28)



Timers

The direct-drive timer diagnosis and replacement is exactly the same as a belt-driven model. Two additional notes:

1. Timer knobs break off with frequency.
2. **Caution**, if a timer misses the pause during the spin cycle, it can be interpreted as a bad transmission instead of a bad timer

Water Valves and Water Level Switches

See the same subject under belt-driven Whirlpool.

Bleach Dispenser

The direct-drive bleach dispenser hose on the right-hand front side of the cabinet occasionally comes loose. It folds down and allows water to drain out of the tub. Sometimes the fitting breaks off the bleach dispenser rather than just slipping off. These failures are caused by off-balance loads.

Bleach Dispenser Hose (Fig. 022-29)



Lid Switch

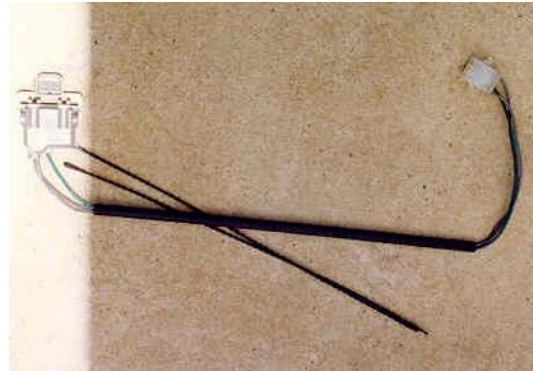
The lid switch is a source of frequent problems. It's fragile and breaks easily. A washer with a bad lid switch will be dead in the spin cycle.

There are two styles of lid switches. The older and more fragile style uses a standard micro switch mounted in a plastic housing.

If the switch itself fails, it can be replaced through the top. If the arm breaks off a conversion kit is required.

The new style includes an entire assembly and cable. It is a stronger design and holds up better. It is necessary to remove the cabinet to install the revised design.

Lid Switch Kit (Fig. 022-30)



Bypassing the Lid Switch

With the cabinet removed for inspection, the lid switch mechanism is disconnected. Of course the machine will not spin. That's not very convenient. How do you test the spin cycle?

Uncle Harry's
Trick of the Trade # 2-23

To test the spin cycle, make up a shunt from an old lid switch cable and temporarily plug it into the lid switch connector. It will allow you to test very easily.

Homemade Lid Switch Shunt (Fig. 022-31)



Spin Drive Assembly

The direct-drive spin drive assembly is similar in construction to the belt-driven style except that it's simpler. It too has a tub block and spin tube. Diagnosis procedures are the same as for the belt-driven models. Just like its predecessor, the clutch shoes wear out and the machine fails to reach full spin speed.

A second failure occurs if parts of the brake linkage break. The brake shoes must be totally released during spin. A broken brake linkage will cause the clutch package to drag.

In either case, a new basket drive kit is needed. Basket drives can be easily rebuilt while they are still in the washer.

Spin Assembly & Kit (Fig. 022-32)



Replacing a Basket Drive

1. Remove the cabinet shell.
2. Remove the agitator, tub top, basket nut and basket.

(This procedure is very similar to the belt-drive.)

3. Remove the water hoses and lay the washer on its back
4. Unclip the pump and bend it aside leaving the hoses attached. Disconnect the motor cable.
5. Remove the three transmission bolts.
6. Slide out the entire transmission and basket drive as one unit.

The entire assembly can be removed in about fifteen minutes. It is possible to rebuild the clutch and have the washer back together in less than an hour.

Direct-Drive Unit Removed (Fig. 022-33)



Transmissions

Many direct-drive transmissions are still covered under the five-year factory warranty. Most of the problems so far, have involved the internal spin linkage.

Remember, the transmission idles during the beginning of the spin cycle. When the timer pauses during spin, a linkage inside the transmission locks in the output shaft. On the second start (of the spin rotation of the motor), the basket begins to spin. Failure of this linkage to lock in was a problem on some early models.

The transmission, without the basket drive, can be removed without pulling the cabinet.

1. Remove the agitator, and lay the washer on its back.
2. Remove the three transmission bolts pump, and motor connector.
3. Slide the unit out through the hole in the bottom frame.

Motor

The drive motor reverses between wash and spin. This makes diagnosis a little harder. Here are some clues:

Uncle Harry's
Trick of the Trade # 2-24

If you happen to have access to a junk washer, salvage the motor connector cable. Make up your own test cord. Connect yellow and white to one side of a spare line cord. Connect blue and red to the other side. Use your new test cord to test a suspicious motor. If the motor is OK on the cord, your problem is elsewhere.

Other hints:

1. The motor connector pins can become loose or dirty. Try wiggling the connector while the motor is running. Clean or tighten as needed.
2. If the motor runs on some segments of the timer and not others, the problem is not likely to be the motor. Rather it will be the timer or the lid switch.
3. Get your eyes and nose close to the motor and check for burned wiring.

Motors are less likely to fail than timers. If a motor does fail, it usually stands right out. Most often, it will burn or stink when you test it.

The motor is held in by two spring clips. It is very easy to replace, once the cabinet is off and the pump pushed aside.

Conclusion

So far the other components have held up well. However, with the direct-drive model still being relatively young, many new problems await us. It is still early for main bearing failures and other major problems. This concludes our study of Whirlpool washing machines. Next we will study all the other brands, starting off with General Electric.

Previews of Coming Attractions

Lesson 3 includes a complete study of all other brands of automatic washers.

General Electric Automatic Washers

Flow Charts
Component by Component
The Clutch Assembly
Changing a Transmission
Changing a Clutch

Maytag Automatic Washers

Flow charts
Component by Component
Stem Seals and Boot Kit
Drive Motor Problems

The Off-Brands

Norge
Amana
Speed Queen
Frigidaire

Flat Rates

Following is *Uncle Harry's* suggested pricing for typical Whirlpool washer repairs. A complete set of flat rates is in the Flat Rate Book.

Whirlpool Belt-Driven Washers (Kenmore, KitchenAid, Roper & In-Sink-Erator)

Description of the Job	Price
1) Replace and adjust belt (95405)	\$95.00
2) Replace pump (two hose, 35065)	135.00
3) Replace pump (three hose, 285317)	140.00
4) Replace pump (four hose, 350367)	140.00
5) Pumps and belt together	160.00
6) Replace wig-wag assembly (84867)	125.00
7) Reseal outer tub (with donut seal, 93553 and oversize washer kit, 76673)	165.00
8) Replace fill valve (CW151)	98.00
9) Replace timer knob (355519 or 3362624)	78.00
10) Install two speed motor	230.00
11) Install timer	190.00
12) Spin drive assembly	240.00
13) Replace bearings, seals and clutch	295.00
14) Repair hose or drain fitting leaks (285743)	95.00
15) Replace sheared drive block (389140 or 96384)	145.00
16) Replace lid safety switch	120.00
17) Replace off-balance switch (350780)	125.00
18)	
19)	
20)	

Whirlpool Direct-Drive Washers (Kenmore, KitchenAid, Roper & In-Sink-Erator)

Description of the Job	Price
1) Replace pump (3363394)	\$135.00
2) Replace fill valve (CW151, for most)	108.00
3) Replace timer knob (see belt drive)	78.00
4) Install two speed motor (389248)	230.00
5) Install timer	190.00
6) Spin drive assembly (9285761 and others)	240.00
7) Repair hose or drain fitting leaks	95.00
8) Replace sheared drive block	145.00
9) Replace lid safety switch (285671)	128.00
10) Replace sheared motor coupling (285743)	125.00
11) Replace transmission	265.00
12) Repair bleach dispenser hose	95.00
13)	
14)	
15)	
16)	

Examination

Manual 2

Automatic Washers

(Note: More than one answer maybe correct.)

The following apply only to belt-drive.

1. A washer has a bad lid switch. How will it act?
 - A. It will not agitate.
 - B. It will not fill.
 - C. It will not spin.
 - D. It will not drain.

2. On spin the washer makes in **awful** vibrating noise. What is most likely wrong?
 - A. main bearings.
 - B. motor.
 - C. lid switch.
 - D. pump.

3. What makes belt replacement difficult?
 - A. removing the pump
 - B. dropping the transmission
 - C. removing the transmission brackets
 - D. A, B, &C

4. Looking from the rear the right hand cam bar
 - A. shifts the pump to drain.
 - B. shifts the clutch into spin.
 - C. controls the water cutoff.
 - D. raises the basket.

5. The yellow wig-wag wire connects to
 - A. the left hand solenoid.
 - B. the water valve.
 - C. the right hand solenoid.
 - D. the off-balance switch.

6. Muddy rings around the inside of the cabinet indicate
 - A. a flooded basement
 - B. a leaking hose.
 - C. bad main seals.
 - D. a worn out washer.

7. A stuck clothes basket
 - A. requires a heavy duty puller.
 - B. can usually be broken loose by hand.
 - C. means a new washer.
 - C. should be smacked with a hammer.

8. A hole in the outer tub
 - A. can be patched.
 - B. takes too much time to fool with.
 - C. is best repaired with a new tub.
 - D. is hopeless.

9. An off-balance switch
 - A. can be bypassed.
 - B. should never be bypassed.
 - C. makes a buzzing noise.
 - D. rings a bell.

10. A lid safety switch
 - A. can be bypassed.
 - B. should never be bypassed.
 - C. is a common problem.
 - D. can be tested with a screwdriver.

The following apply only to direct-drive.

11. The direct -drive design
A. represents little change
B. is more complicated
C. is much sturdier
D. is a complete redesign

12. To service the direct-drive
A. remove the entire cabinet
B. remove the rear cover
C. take off the top
D. turn it up side down

13. The motor drives through
A. the usual belt
B. a plastic coupling
C. a drive web
D. a metal spline

14. During spin the
A. timer pauses to lock the transmission
B. lid can be up
C. pump is usually noisy
D. washer often shakes

15. If the lid switch is broken
A. watch out for a shock
B. the washer goes completely dead
C. the motor runs, but it won't spin
D. the washer is dead in spin

16. Test the lid switch with
A. an ohm meter
B. a screwdriver
C. a new one
D. your hand

17. If the coupling is sheared the washer will
A. spin but not wash
B. spin but not drain
C. wash but not spin
D. drain but not spin

18. Water valves are
A. completely different
B. the same as belt drive
C. always trouble
D. not a money maker

19. A spin switch shunt
A. is unsafe
B. a good homemade test device
C. breaks frequently
D. is expensive

20. A basket drive repair
A. can be done in the field
B. should be avoided
C. is too expensive
D. can be done from the top

Extra Credit Question:

What happens if the yellow wig-wag wire is broken on a belt-drive model?

Examination Answers

Manual 2

Automatic Washers

1. C. A belt-driven washer with a bottom lid switch will not spin. The washer will agitate, fill, and it will drain.
2. A. Worn out main bearings can cause severe vibration when the washer is in spin.
3. D. Belt replacement is difficult; it requires removing the pump, dropping the transmission and removing the transmission brackets.
4. The right hand cam bar, looking from the rear of the machine, shifts the pump into drain and also engages the transmission. The left hand cambar raises and lowers the spin cambar and shifts the clutch into spin.
5. C. Looking from the rear, the yellow wig-wag wire connects to the right hand solenoid and the red wig-wag wire connects to the left hand solenoid.
6. D. Worn out main bearings will allow water to leak onto the clutch and splatter muddy rings around the inside of the cabinet.
7. B. By shaking a clothes basket with both hands, it can usually be broken loose and lifted out. Hitting it with a hammer can damage the basket by chipping the porcelain.
8. A. Most holes in the outer tub can be easily patched.
9. A or C. A faulty off-balance switch can be bypassed and removed from the circuit.
10. B, C, and D. A lid safety switch should never be bypassed. A careless person could easily be hurt. A bad lid switch is a common problem and can be easily tested with a screwdriver.

11. D. The direct drive Whirlpool was a complete change in redesign.

12. A. It is possible to remove the entire cabinet in less than 2 minutes and gain complete access for service.

13. B. The motor is coupled to the transmission by a plastic and rubber coupling.

14. A After an initial drain, the timer pauses, locks in the transmission, and spin begins.

15. D. A broken lid switch results in a dead washer during the spin cycle. The washer will only fill and agitate. It will not drain or spin.

16. B. The faster way to test a lid switch is to listen to the click with a small screwdriver.

17. D. A washer with a sheared coupling will drain, but it will not spin. Also, it will not wash.

18. B. Most washer valves are interchangeable between all brands and all models.

19. B. A homemade spin safety shunt allows you to test the washer with the cabinet removed.

20. A. A basket drive replacement, after some experience, can be done out in the field in an hour.

Extra Credit Question (worth 5 points):

A washer with a broken yellow wig-wag wire will fill and drain over and over without agitating.