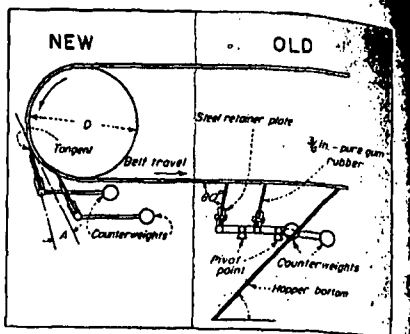
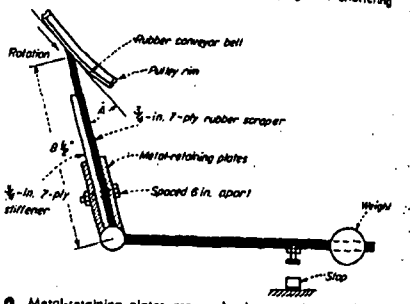


1 Occasional check on conveyor-scraper counterweights assures correct pressure is applied by scraper against belt



2 Changing the angle between belt and scraper, then shifting scraper location, brought end to annoying belt chattering



3 Metal-retaining plates are made short so they won't bind on conveyor if the scraper turns over; belt might be ripped

Small Changes Lick These Conveyor Problems

Plant-made improvements on this coal-conveyor scraper show how operating ingenuity can often get the best of knotty problems in your equipment design

Here Jim Campbell, boiler-room engineer at Detroit Edison Co, tells each of the steps they've gone through and the success they've had in ending chatter, reducing maintenance

► SLIGHTLY INCLINED, coal-belt-conveyor scrapers, installed in Conners Creek powerhouse, met with moderate success. But plant-made improvements have worked even better. Original scraper setup, Fig. 2, was used in some 49 locations, most near head, but some near tail pulleys.

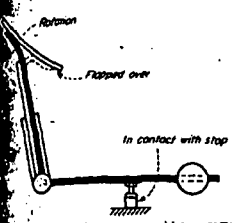
Belt Chattering. When this type scraper removes coal, it "rolls" the coal under scraper belt, dropping off on downstream side of scraper. Because of this rolling action, sufficient space was always left between hopper sides on scraper so coal could fall below. We found angle of hopper should be over 60 degrees to allow scraped coal to slide more freely.

Original double-scraper is still used in many locations, as at either end of reversible conveyors. Here, on these reversing applications, minor chattering was often noticed.

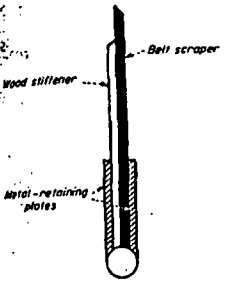
To lick the chattering problem, angle of contact with belt was reduced, Fig. 2. Changing the angle and placing scraper in contact with belt, at point where belt passed over pulley, made a marked improvement in scraping. Reducing angle *A* was of major importance. Following table lists most efficient angle *A* (scraper to pulley tangent) for various pulley diameters.

Pulley diameter, in.	*Angle A, deg*
24	20
36	25
42	27
48	30

Present Scrapers. Present scraper, Fig. 3, using 7-ply ¾-in. rubber, was field-tested, and no excessive wear or



4 Softening of scraper-rubber may cause flopover, even with proper stop

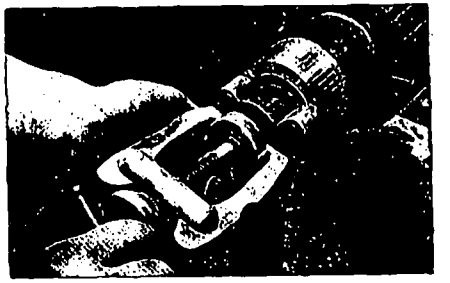


5 White pine gives better stiffness, carries off heat faster than ply-rubber

burning was noticed. We've found ply rubber gives better scraper stiffness. Stops were placed on the weight lever to prevent scraper from flopping over, plus giving simple indication as to scraper wear.

Metal-retaining plates, Fig. 3, are made short so they won't bind on conveyor if scraper turns over. Otherwise, if plates were too long, belt could be ripped or burned. Even with proper stop-setting, scraper occasionally flops over. We trace this to heating of scraper rubber, causing it to soften and conform to pulley, Fig. 4.

But this last problem has apparently been licked with a still newer design, Fig. 5. Here, white pine replaces the ply-rubber stiffener. White pine conducts heat away twice as fast as rubber and gives better stiffness.



Noisy Bearings Up Maintenance

► FOR A REALLY QUIET BEARING, the balls, inner and outer races must be highly polished and regular. Races must be perfect circles and balls perfectly spherical, all dimensions held to close tolerances. And such is the case with a bearing from a reputable manufacturer. Noise problems generally come from poor installation.

All the topnotch workmanship the manufacturer put into the bearing can be ruined by poor fitting and careless installation. Ruined from the noise angle too. For example . . .

Shrink Fitting. For bearings larger than the one above, it's not uncommon to shrink-fit by preheating the bearing in an oil bath or oven. Trouble comes when shrinking takes up the designed internal bearing clearances. When bearing operates, the inner race tries to expand. Where the internal clearance has been taken up by shrinking, you come up with a "preloaded" condition. This shows up by bearing being noisy, and generally results in early failure.

In any normal ball-bearing setup about 70% of shaft-diameter excess is translated into expansion of inner race. This, in turn, means a corresponding decrease in internal clearance.

What is good practice? As we see it, there's little disagreement on the need for a reasonably tight fit between shaft and inner race. At the same time, undue squeezing of bearing on shaft must be avoided. From the noise angle, a bearing with a *medium-to-loose* internal clearance is preferred for motor applications.

But if you shift to the other extreme—excessive clearance, especially if accompanied by critical operating conditions and unfavorable balance—you may wind up with "shaft whip" or progressive gyration of shaft around bearing's internal clearance at a fast clip. Mechanical vibration results with a vibration frequency having no apparent relation to speed or other factors.

Where you run into such a condition, the vibration can be damped with an axial-thrust washer, which applies a thrust load to outer race of one bearing while taking up internal clearances of both bearings. The bearings are then lightly spring loaded. Stabilizing washers of this type are available from several manufacturers.

Bearing Housing. Fit between bearing housing and end bracket should be snug, but not to the point where the outer race is distorted, knocking out alignment with the ball track.

Cleanliness is a major consideration in handling ball bearings. This is the first rule laid down to any apprentice in a repair or maintenance shop. Noise and early failure stems from dirt, grit or foreign matter reaching the ball track.

—JIM SPARKS, *St. Louis, Mo.*