THE PENNSYLVANIA RAILROAD

LOP-219C

INSTRUCTIONS

FOR THE

USE AND CARE OF ABRASIVE (GRINDING) WHEELS

C. J. Code
Assistant Chief Engineer- Staff

D. E. Rudisill
Assistant Chief Engineer-
Maintenance

C. J. Henry
Chief Engineer

ISSUED
November 1, 1961

Make	Model	R.P.M.	Ref. No.	Type	Used For
Nordberg (Bit Grinder)	G.R.	1800	24237	1	Sharpening Adzer Bits
" (" ")	P.G.	1800	24237	1	" " " & Drill Bits
" (Angle Head)	SG, TG & UG	3000	22849	2	Surface Grinding
" (" ")	SG, TG & UG	3000	22984	2	" "
"	SG & FG	3500	23996	7	Grinding lips off stock and switch rails
"	SG, TG & UG	3500	24169	5	" " " " " " "
"	SG, FG, TG & UG	3500	24209	1	General Grinding
"	SG, FG, TG & UG	3500	24228	1	Slotting Rail Ends
"	SG, FG, TG & UG	3500	21447	1	For grinding throats of frogs, etc., on side of wheel
"	TG & UG	3500	24207	13	Grinding spots out of frogs
" Midget	EG	3700	22984	2	Surface Grinding
" "	EG	3700	22849	2	" "
" P-22 Coupling	SG	3500	24193	1	Slotting Rail Ends
" " "	SG	3500	24218	1	General Grinding
" " "	SG	3500	22849	2	Surface Grinding
" " "	SG	3500	22984	2	" "
" " "	SG	3500	23724	1	Grinding Engine Burns out of Rail in Track
Prairie Tool Co. (Hand)	27R6		22826	1	Sharpening Tools and General Grinding

Make	Model	R.P.M.	Ref. No.	Type	Used For
Ingersoll-Rand	7	3000	24168	1	General Grinding
" - "	601	4200	24162	1	" "
" - "	601	4200	24168	1	" "
" - "	601	4200	24209	1	" "
" - "	4-V-6	4500	24209	1	" "
Keystone	Hand		24191	5	Sharpening Tools and General Grinding
Mall (Now Remington)	P-22 Coupling	3900	23724	1	Grinding engine burns out of rail in track
" (" ")	" "	3900	24193	1	Slotting Rail Ends
" (" ")	" "	3900	24218	1	General Grinding
" (" ")	" "	3900	22984	2	Surface Grinding - use with Adaptor Plate
" (" ")	" "	3900	22849	2	" " " - " " " "
" (" ")	" "	3900	21448	1	Grinding throats of frogs, etc. on side of wheel
" (" ")	Flexible Shaft	3900	21447	1	" " " " " " " " "
" (" ")	" "	3900	22849	2	Surface Grinding - use with Adaptor Plate
" (" ")	" "	3900	22984	2	" " " " " "
" (" ")	" "	3900	24086	1	General Grinding
" (" ")	" "	3900	24087	1	Slotting Rail Ends
Millers Falls Electric	406	3600	24161	1	General Grinding
" " "	406	3600	24228	1	Slotting Rail Ends

GENERAL

1. (a) When in use all abrasive wheels shall be provided with protection hood or wheel guard and protection flanges of steel.

(b) The removable outside portion of guard for the straight hand pieces used with all flexible shaft grinders must be in place when the hand piece is in use.

(c) The position of the band type guard, used with cylinder and cup type grinding wheels, must be kept so adjusted that at no time will the wheel protrude beyond the edge of the band or guard a distance greater than indicated in the table below:

Overall Thickness of Wheel (T) in inches	Maximum exposure of wheel beyond edge of guard in inches
1"	1/2"
2"	3/4"
3"	1"
4"	1-1/2"

2. Grinding machine on which the abrasive or grinding wheel is used must be sufficiently rigid and substantial to minimize vibration.

3. Grinding wheels should be used only on machines as indicated in paragraph 37, unless otherwise instructed by the proper authority.

4. Grinding Machine Operators shall be qualified by an authorized examiner in accordance with paragraph 5 of Manual of Instructions - Maintenance of Way Equipment (MW52) and Safety Rule 3260. Record of such examination shall be maintained in accordance with LGP 258.

HANDLING & STORAGE

5. All grinding wheels are breakable and some are very fragile. Great care shall be exercised in handling and storage to prevent damage. The following rules, which are based on experience, shall always be observed.

(a) Handle wheels carefully to prevent dropping or bumping.

(b) Do not roll wheels (hoop fashion).

(c) Use trucks or suitable conveyors (which will provide proper support) for all transportation of wheels which cannot be carried by hand.

6. Extreme care must be taken in the storage of grinding wheels. Suitable racks or bins shall be provided to accommodate the various types of wheels carried in stock.

7. Straight and tapered wheels, 1/2" or more in thickness, are best supported on edge in racks. Thin rubber, shellac and other organic bonded wheels should be laid flat to prevent warpage.

8. Cylinder wheels and cup wheels should be stacked on the flat sides with cushioning material between them.

9. Paragraph 38 shows by reference numbers whether wheels should be stored flat or on edge.

10. Grinding wheels absorb moisture and when left exposed to rain, dew or fog must be carefully protected, for if a portion of the wheel is exposed it will absorb water and throw the wheel out of balance, causing excessive vibration while operating at high speeds and may result in the breaking of the wheel with perhaps a resultant personal injury.

11. Grinding wheels must never be placed on damp or wet ground, even for short periods of time.

INSPECTION

12. All grinding wheels must be closely inspected before mounting to make sure that they have not been injured in transit or otherwise. As an added precaution, wheels should be tapped gently (while suspended) with a light non-metallic implement, such as the handle of a screwdriver. Wheels should be dry and free from sawdust when applying the test, otherwise the sound will be deadened. Organic bonded wheels do not give the same clear metallic ring as do the vitrified or silicate wheels. If new wheels when tapped do not give a ringing sound, they shall not be used.

13. All grinding machines must be inspected each day by the operator to see that the arbors, adaptors, or other machine parts on which the wheels fit are free from wear. When signs of wear are seen, new parts must be obtained and applied.

SPEED OF GRINDING WHEEL

14. The maximum operating speed in R.P.M. will be shown on a label on each wheel by the manufacturer. Before applying a grinding wheel the grinding machine operator shall see that the maximum operating speed shown on the wheel is not less than the speed of the grinding machine.

15. The speed of all grinding machines must be checked daily by the machine operator, using a tachometer (speed counter). When the speed is in excess of that shown in the list (See Paragraph 37) for the particular make of machine, adjustment must be made to give the machine its proper speed.

16. Where the speed of the wheel spindle is adjustable, speed adjustment shall be made by the operator.

CAUSES OF GRINDING WHEEL BREAKAGES

17. Everything must be done to prevent breakage and proper guards must be used to limit extent of damage and injury in the event of wheel failure.

18. Some of the outstanding causes of wheel breakages on portable grinding machines are:

(a) Improper mounting of the wheel, including worn or distorted adaptor face plates.
(b) Improper speeds.
(c) Abusive operation.
(d) Careless handling.
(e) Oil or moisture soaked wheels.

DRESSING

19. Dressing or truing of grinding wheels on portable grinders in the field is prohibited since it is unsafe to attempt this without a rigid support for the grinder and the work rest upon which the dressing tool can be hooked.

20. Bench and floorstand grinders used for off-hand grinding may be dressed with a hand dressing tool of the star or "Huntington" type, in which star shaped discs are assembled on a pin with spacers and the whole assembly mounted in a holder. When using this dressing tool the lugs on the holder must be engaged by the work rest to provide a fulcrum as the tool is levered against the rotating wheel and moved slowly across its face.

MOUNTING

21. Grinding wheels must fit freely on the spindles and should not be forced on, nor should they be too loose.

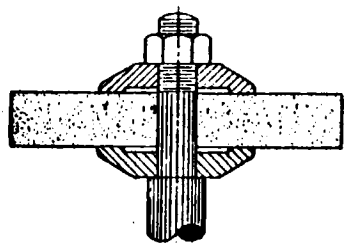
22. Washers or flange facing of compressible material, such as blotting paper, must be fitted between the wheel and its flanges.

23. When tightening spindle nuts care must be taken to tighten them only enough to hold the grinding wheel firmly, otherwise the clamping strain is liable to damage the grinding wheel.

CORRECT AND INCORRECT MOUNTING OF THE STRAIGHT TYPE GRINDING WHEEL

Flanges Matched

24. Both the fixed and loose flanges between which a wheel is mounted should be of the same diameter and properly relieved. (See Figure 1.)



CORRECT

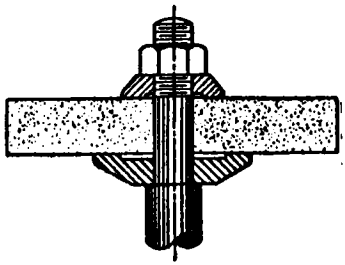
FLANGES ARE EQUAL IN OUTSIDE DIAMETER
AND
RELIEVED TO PRODUCE EQUAL AND
OPPOSITE BEARING AREAS

FIG. 1

Flanges Not Matched

25. If they are not the same diameter, the wheel is under a bending stress which is liable to cause fracture. (See Figure 2.)

26. If they are not properly relieved, the pressure of the flanges is concentrated on the sides of the wheel near the hole, a condition which should be avoided. (See Figure 2.)



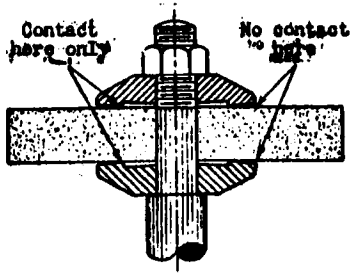
INCORRECT

FLANGES ARE NOT MATCHED
IN DIAMETER OR RELIEF

FIG. 2

Distorted Flanges

27. Uneven flange pressures, caused by distortion of the flanges due to excessive tightening, creates a dangerous condition. When flanges are "sprung" or distorted, the effective area of contact is reduced and the pressure is moved nearer the hole. (See Figure 3.)



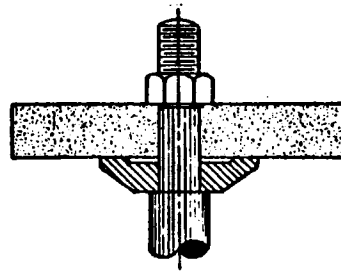
INCORRECT

"SPRUNG" FLANGES
CAUSED BY
EXCESSIVE TIGHTENING

FIG. 3

Outer Flange Omitted

28. Both flanges serve a useful purpose and it is dangerous to omit either. In Figure 4 the outer flange has been omitted and the nut tightened directly against the wheel.

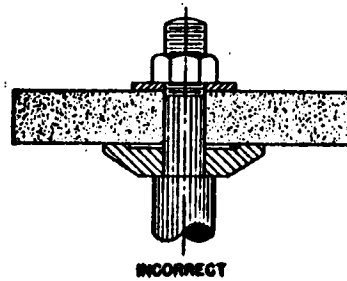


OUTER FLANGE OMITTED

FIG. 4

Substitute Flange

29. A washer or steel punching is a dangerous substitute for a properly relieved flange. (See Figure 5.) The bending stress imposed is liable to cause fracture of the wheel.

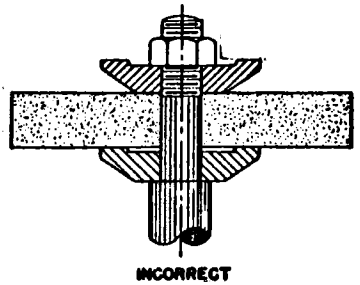


UNSATISFACTORY SUBSTITUTE
FOR
PROPERLY RELIEVED FLANGE

FIG. 5

Outer Flange Reversed

30. The condition illustrated in Figure 6 results in unequal bearing against the wheel, and is the same as using flanges of unequal diameter.



OUTER FLANGE REVERSED

FIG. 6

CORRECT MOUNTING OF THE PLATE MOUNTED TYPE GRINDING WHEEL

31. Plate mounted wheels have a plate of steel or other rigid material securely and permanently anchored to one side. Grinding is always done on the exposed flat side. This plate is provided with a set of clear holes.

Portable grinders shall be adapted for using this type of wheel by screwing an adaptor plate (a flat steel disc wheel expressly made for the grinder in use) to the threaded arbor of the angle hand piece. The plate mounted wheel is then attached to this adaptor plate by suitable set screws passing through the clear holes provided in the plate mounting and securely tightened into the threaded holes provided for them in the adaptor plate. (See Figure 7.)

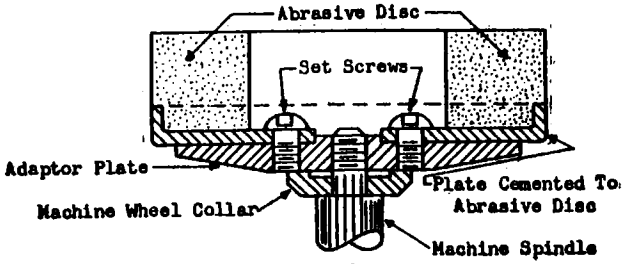


Fig. 7

STARTING NEW GRINDING WHEELS

32. All new grinding wheels shall be run at full operating speed for at least one minute before grinding. The first contact made with the wheel on the material to be ground should be light, to allow the wheel to become heated so as to permit any defects in the wheel to indicate their presence. During this time the grinding machine operator must place himself to one side, out of range of any possible danger if the wheel should break.

33. The grinding machine operator must not place himself in a hazardous position, nor allow any of his fellow-workmen to do so, while the grinding machine is in operation.

34. (a) Grinding on the rim of cylinder (Type 2) or cup wheels is prohibited.

(b) Grinding on the flat side of straight (Type 1) wheels, except those specified in paragraphs 37 and 38, is prohibited.

35. Wheels out of balance through wear, which cannot be balanced by truing or dressing, shall be removed from the machine and discarded.

WHEEL BREAKAGE

36. Whenever a grinding wheel breaks, a careful inspection shall be made to make sure that the hood or guard has not been damaged, nor the flanges bent or sprung out of true or balance. The spindles and nuts shall also be carefully inspected. A full report of each broken wheel must be made to the Chief Engineer.

GRINDING WHEELS TO BE USED WITH M.W. PORTABLE GRINDING MACHINES

All grinding wheels are in Account 45B which should be shown as the prefix number with the reference number given in tables below.
For example: Reference 45B-24161 = Material Catalog Reference Number to be used in ordering.

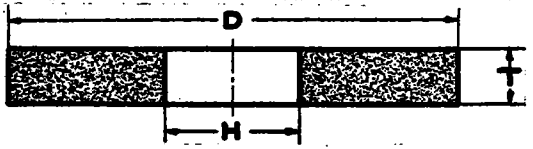
Make	Model	R.P.M.	Ref. No.	Type	Used For
ack & Decker	61	3300	24161	1	General Grinding
icago Pneumatic	33	4175	24162	1	General Grinding
" "	33	4175	24168	1	" "
" "	66	5800	24162	1	" "
" "	3221	4175	24162	1	" "
icago Electric		3600	24161	1	General Grinding
ncinnati Electric	H.H.U.	3600	24161	1	General Grinding
ico	5/8" Arbor	4000	24161	1	Grinding Rail Head for Application of Cadweld Bonds
"	3/4" "	3100	20321	1	" " " " " " " "
"	3/4" "	3100	23756	5	" " " " " " " "
ston Electric		4500	24169	5	Surface Grinding
dependent Pneumatic	71	4500	24209	1	General Grinding

Make	Model	R.P.M.	Ref. No.	Type	Used For
Ingersoll-Rand	7	3000	24168	1	General Grinding
" - "	6CR	4200	24162	1	" "
" - "	6CR	4200	24168	1	" "
" - "	6CR	4200	24209	1	" "
" - "	4-V-6	4500	24209	1	" "
Keystone	Hand		24191	5	Sharpening Tools and General Grinding
Mall (Now Remington)	P-22 Coupling	3900	23724	1	Grinding engine burns out of rail in track
" (" ")	" "	3900	24193	1	Slotting Rail Ends
" (" ")	" "	3900	24218	1	General Grinding
" (" ")	" "	3900	22984	2	Surface Grinding - use with Adaptor Plate
" (" ")	" "	3900	22849	2	" " " " " "
" (" ")	" "	3900	21448	1	Grinding throats of frogs, etc. on side of wheel
" (" ")	Flexible Shaft	3900	21447	1	" " " " " " " " "
" (" ")	" "	3900	22849	2	Surface Grinding - use with Adaptor Plate
" (" ")	" "	3900	22984	2	" " " " " "
" (" ")	" "	3900	24086	1	General Grinding
" (" ")	" "	3900	24087	1	Slotting Rail Ends
Millers Falls Electric	406	3600	24161	1	General Grinding
" " "	406	3600	24228	1	Slotting Rail Ends

Make	Model	R.P.M.	Ref. No.	Type	Used For
Nordberg (Bit Grinder)	G.R.	1800	24237	1	Sharpening Adzer Bits
" (" ")	P.G.	1800	24237	1	" " " & Drill Bits
" (Angle Head)	SG, TG & UG	3000	22849	2	Surface Grinding
" (" ")	SG, TG & UG	3000	22984	2	" "
"	SG & FG	3500	23996	7	Grinding lips off stock and switch rails
"	SG, TG & UG	3500	24169	5	" " " " " " "
"	SG, FG, TG & UG	3500	24209	1	General Grinding
"	SG, FG, TG & UG	3500	24228	1	Slotting Rail Ends
"	SG, FG, TG & UG	3500	21447	1	For grinding throats of frogs, etc., on side of wheel
"	TG & UG	3500	24207	13	Grinding spots out of frogs
" Midget	EG	3700	22984	2	Surface Grinding
" "	EG	3700	22849	2	" "
" P-22 Coupling	SG	3500	24193	1	Slotting Rail Ends
" " "	SG	3500	24218	1	General Grinding
" " "	SG	3500	22849	2	Surface Grinding
" " "	SG	3500	22984	2	" "
" " "	SG	3500	23274	1	Grinding Engine Burns out of Rail in Track
Prairie Tool Co. (Hand)	27B6	-	22826	1	Sharpening Tools and General Grinding

Make	Model	R.P.M.	Ref. No.	Type	Used For
ailway Track-Work	P-11, P-22 & P-44	3620 - 4500	24193	1	Slotting Rail Ends
" " "	P-16 with flexible shaft	3600	24193	1	" " "
" " "	P-16	3600	23956	7	Grinding lips off stock and switch rails
" " "	P-16, P-22 & P-44	3600 - 4500	24218	1	General Grinding
" " "	P-16	3600	23996	7	Grinding lips off stock and switch rails
" " "	P-16, P-22 & P-44	3600 - 4500	22849	2	Surface Grinding - use with Adaptor Plate
" " "	P-16, P-22 & P-44	3600 - 4500	22984	2	" " " " " "
" " "	P-22 & P-44	3600 - 4500	21450	13	Cutting Spots out of Frogs
" " "	X-60	3600 - 4500	24228	1	Slotting Rail Ends
" " "	P-16, P-22 & P-44	3600 - 4500	21448	1	Grinding throats of frogs, etc., on side of wheel
" " "	P-22	3600	23274	1	Grinding Engine Burns out of Rail in Track
towe Mfg. Company	SDD5	4000	24209	1	General Grinding
yntron	UG	3600	24161	1	General Grinding
.S. Electric	RU	3500	24133	1	General Grinding
R Grinding Cars		3600	24255	2	Surface Grinding
daptor Plate			22838		For use with Wheels 22849 and 22984 used on Mall and Railway Track-Work Grinders

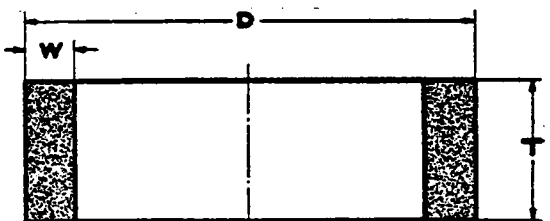
38. DESCRIPTION OF GRINDING WHEELS LISTED IN PARAGRAPH 37



Type 1 - Straight Wheel

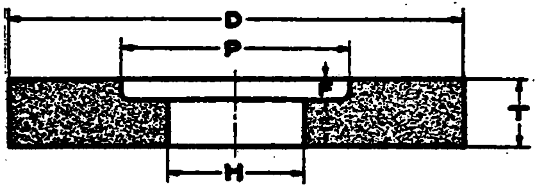
Ref. No.	Size	Bond	R.P.M.	S.F.P.M.	How Stored	Used For
20321	D-6",T-3/4",H-3/4"	Vitreous	3100	4870	On Edge	Grinding Rail Head for Cadweld Bonds
23724	D-8",T-1/2",H-1"	Organic	3900	8169	" "	Grinding Engine Burns out of Rail in Track
24086	D-8",T-1",H-3/4"	"	4500	9425	" "	General Grinding
24087	D-8",T-1/8",H-3/4"	"	5000	10200	Flat	Slotting Rail Ends
24133	D-5",T-1",H-5/8"	Vitreous	3500	4420	On Edge	General Grinding
24161	D-6",T-1",H-5/8"	"	4000	6283	" "	" "
24162	D-6",T-1",H-5/8"	Organic	5800	9111	" "	" "
24168	D-6",T-1½",H-5/8"	"	4200	6598	" "	" "
24193	D-8",T-1/8",H-1"	"	4500	9425	Flat	Slotting Rail Ends
24209	D-8",T-1",H-5/8"	"	4600	9637	On Edge	General Grinding
24218	D-8",T-1",H-1"	"	3900	8169	" "	" "
24228	D-8",T-1/8",H-5/8"	"	4500	9425	Flat	Slotting Rail Ends
24237	D-10",T-1",H-3/4"	Vitreous	1800	4713	On Edge	Sharpening Adzer Bits
21448	D-8",T-1",H-1" Reinforced	Organic	4500	9425	" "	Grinding Throats of Frogs, etc. on Side of Wheel
21447	D-8",T-1",H-5/8" Reinforced	"	4500	9425	" "	" " " " " " " " " "
22826	D-7",T-1½",H-1"	Vitreous	3000	5500	" "	Sharpening Tools and General Grinding

Ref. No.	Size	Bond	R.P.M.	S.F.P.M.	How Stored	Used For	



Type 2 - Cylinder Wheel

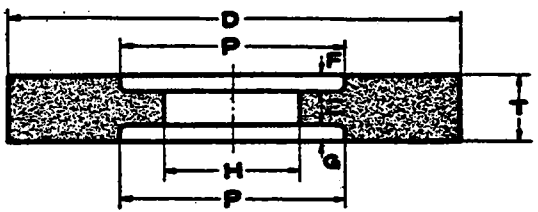
22849	D-8", T-1½", W-2", Stl. pl.	Organic	4000	8378	Flat	Surface Grinding		
22984	D-8", T-2", W-2", Stl. pl.	"	3900	8169	"	"	"	
24255	D-10", T-2", W-2", Stl. pl.	"	3600	9420	"	"	"	with P.R.R. Grinding Cars



Type 5 - Wheel Recessed One Side

Ref. No.	Size	Bond	R.P.M.	S.F.P.M.	How Stored	Used For
23756	D-6",T-1",H-3/4",P-2-3/8",F-1/4",E-3/4"	Vitreous	3100	4870	On Edge	Grinding Rail Head for Cadweld Bonds
24169	D-6",T-3",H-5/8",P-3½",F-2",E-1"	Organic	4500	7069	On Edge or Flat	Surface Grinding
24191	D-7",T-1½",H-1",P-3",F-3/8",E-1-1/8"	Vitreous	3000	5500	On Edge	Sharpening Tools and General Grinding

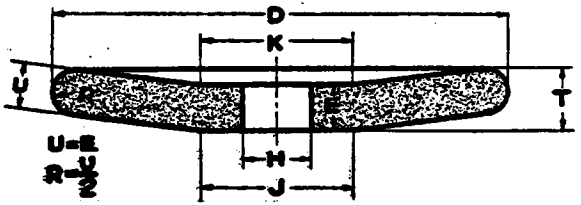
Ref. No.	Size	Bond	R.P.M.	S.F.P.M.	How Stored	Used For



Type 7 - Wheel Recessed Two Sides

23956	D-10",T-2",H-1",P-6",E-3/4",F-5/8",G-5/8"	Organic	3620	9500	On Edge or Flat	Grinding Lips Off Stock & Switch Rails
23996	D-8",T-2",H-1-3/8",P-5½",E- Stl.Pl. 3/16"	"	4500	9425	" " " "	" " " " " " "

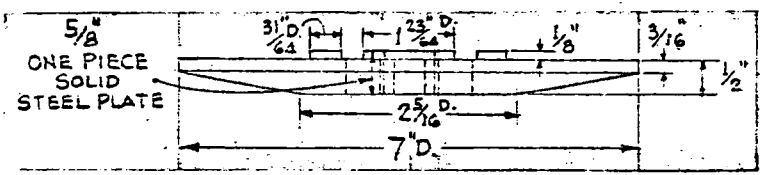
Ref. No.	Size	Bond	R.P.M.	S.F.P.M.	How Stored	Used For



Type 13 - Saucer Wheel

24207	D-8",T-3/4",H-5/8",J-3",K-3",E-½",U-½"	Organic	4000	8378	On Edge	Grinding Spots and Cracks out of Frogs
21450	D-8",T-3/4",H-1",J-3",K-3",E-½",U-½"	"	4000	8378	" "	" " " " " " "

Ref. No.	Size	Bond	R.P.M.	S.F.P.M.	How Stored	Used For



Adaptor Plate

22838

NOTE: R.P.M. = Revolutions per minute (Maximum Safe Operating Speed)
S.F.P.M. = Surface speed in feet per minute