BWG

DRAP Line

Direct Rolling, Annealing & Pickling Line

Technical Data

Line Data	*Line Speeds*	
	Coil Prep. Station:	max. 100 fpm (30.5 mpm)
	Entry Section:	max. 350 fpm (106.8 mpm)
	Mill Section:	max. 185 fpm (56.4 mpm)
	A+P Process Section:	max. 150 fpm (45.8 mpm)
	Exit Section:	max. 245 fpm (74.7 mpm)
	Line Jog:	max. 100 fpm (30.5 mpm)
Strip Data	Materials:	Austenitic, Ferritic and Martensitic Stainless Steel AISI 200, 300 and 400 series
Coil Data	Coil O.D.:	42" – 72" (1,067 – 1,829 mm)
	Coil I.D.	Entry: 20" – 32" (508 – 812.8 mm) Exit: 20" (508 mm)
	Max. Coil Weight:	55,000 lbs (24.95 t)
	Incoming finish:	hot rolled
	Outcoing finishes:	hot rolled, annealed and pickled (No. 1 finish) cold rolled, annealed and pickled (2 D finish) cold rolled, annealed, pickled and temper rolled (2 B finish)
Patents	US-P.-No. 5 554 235	Method of and Process for Cold Rolling of Stainless Steel and Titanium Alloy Strip

BWG

Your partner for innovative technology

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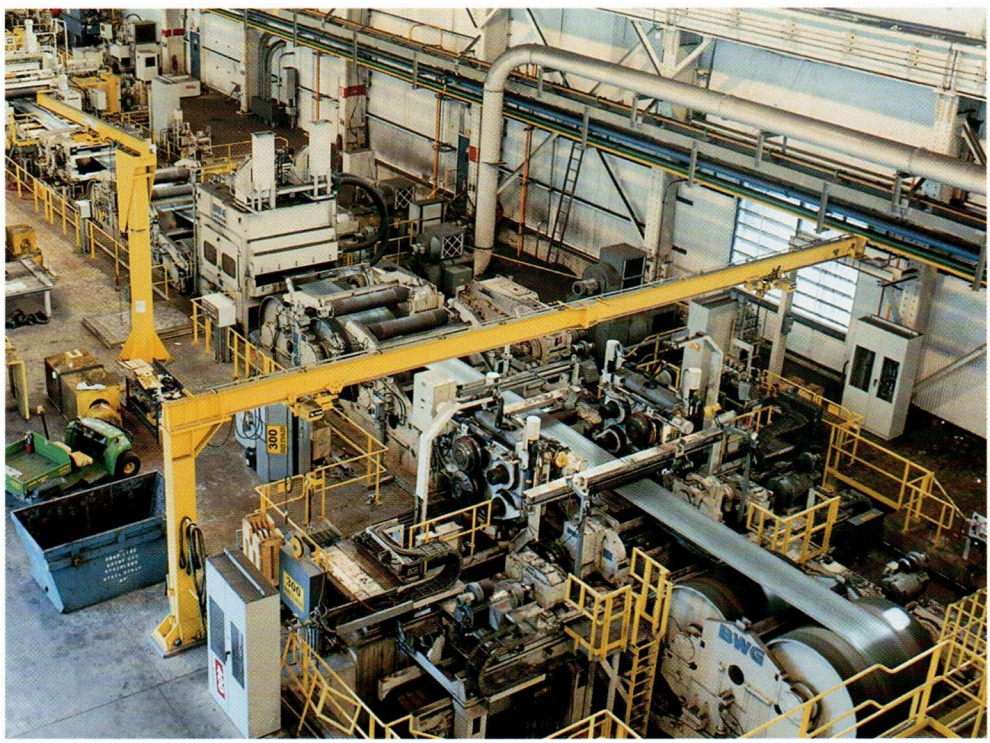
In the conventional production of cold-rolled stainless steel, the production process typically comprises four steps: the metal is first annealed and pickled in a Hot Anneal & Pickle Line, then cold rolled on a single-stand reversing cold mill, and again annealed and pickled in a Cold Anneal & Pickle Line. If the final surface finish is specified as a bright finish (2B finish) versus a matte finish (2D finish), the strip is finally temper rolled on a skin pass mill with polished rolls.

This classic process is time-consuming and both personnel and energy intensive. Due to the coil handling operations between the production steps, there is a relatively high yield loss due to coil damage during transport. A large inventory stock is also required as a buffer between the production units.

J&L Specialty Steel, Inc. recognized these challenges and approached BWG with the request to help develop a process that would allow the production of cold-rolled coils with a 2B finish from incoming hot-rolled coils in a single production unit. The process needed to be environmentally friendly, and the line had to fit within an existing building.



General View Entry Section

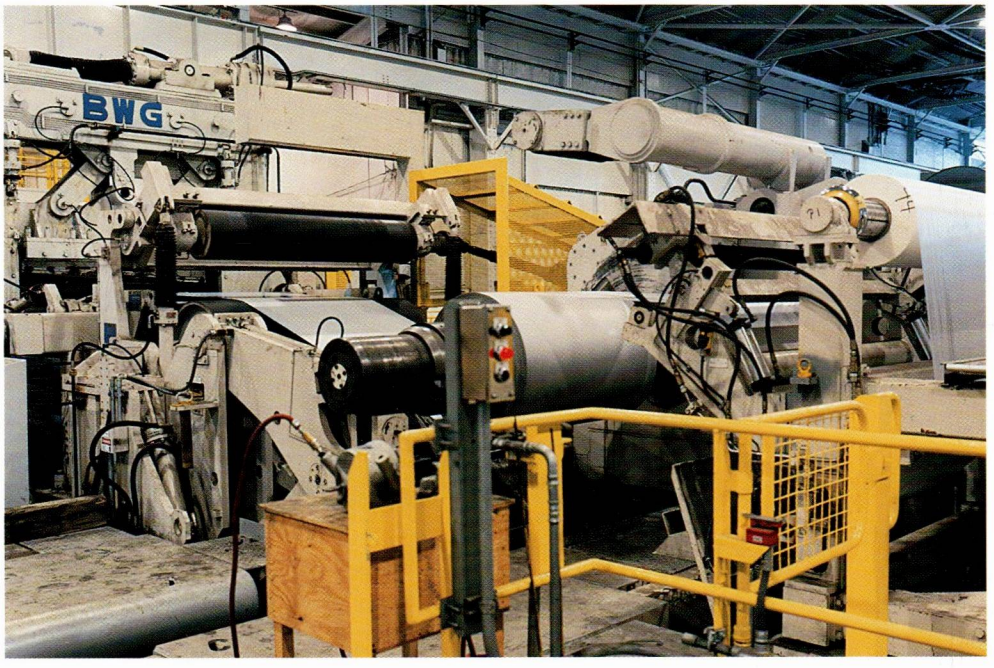
BWG and J&L conducted extensive trials and developed the Direct Anneal & Pickle (DRAP) Line process which has since been patented by BWG and J&L in a number of countries. Based on the laboratory trial results and J&L's own simulation of the new process on its existing production units, an order was placed with BWG to supply the first line of this type worldwide.

Incoming black coils are charged from coil storage onto the entry walking beam. Coil strapping bands are removed at a spin roll station. The head end scrap is then cut off in a semiautomatic coil preparation station and the new coil head end is straightened. The entry coil car loads the coil onto the pay-off reel. From there it is fed into the line. Tail end scrap is cut off and discharged in-line during loading of the next coil. The coils are joined together in an automated MIG-type welding machine. After notching the weld, the strip passes through the BWG Levelflex® Scalemaster machine. In the Scalemaster®, the scale is broken and partially removed by bending the strip around small-diameter flexrolls under high tension. The plastic elongation that occurs in the strip results in the elimination of any incoming waviness. A special version of the fully-automated Scalemaster® ensures optimum descaling and leveling effects for stainless steel materials.

The flat strip is then fed through a turret-type double-head side trimmer. The side trimmer features automatic gap, overlap and width setting as well as a camber follower system. This patented system detects the strip width and strip position relative to the line centerline. The trimmer

heads automatically follow any incoming strip camber or they both move towards the centerline in the case of strip necking.

After passing through the entry accumulator, the strip is subjected to further mechanical descaling in the form of shotblasting and brush polishing. Due to the synergistic action of the three mechanical descaling operations, the strip then enters the cold mill section virtually scale-free. In the two-stand tandem Z-high cold mill the strip thickness is reduced by up to 62 %, depending on the alloy and strip cross-section to be rolled. The Z-high cold mill is equipped with automatic gauge control and automatic flatness control systems on both stands to ensure tight gauge tolerances and good strip flatness. The DRAP Line is flexible in that, if desired, hot-rolled, annealed and pickled product can also be produced, in which case the cold mills are not used.



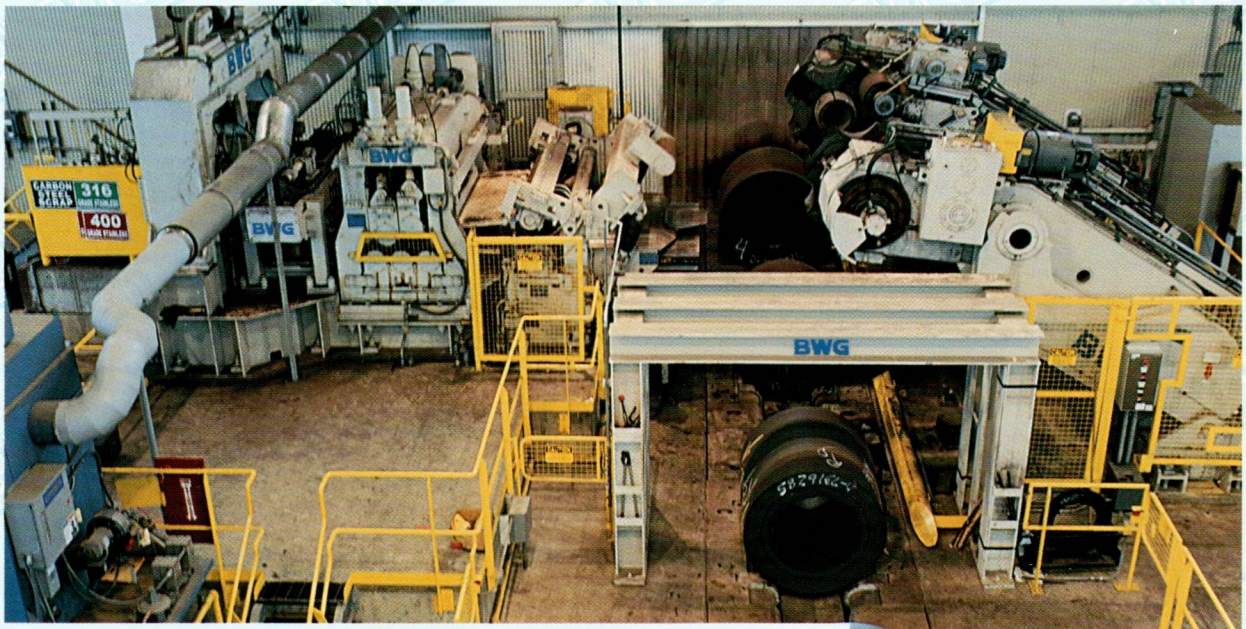
Exit Section

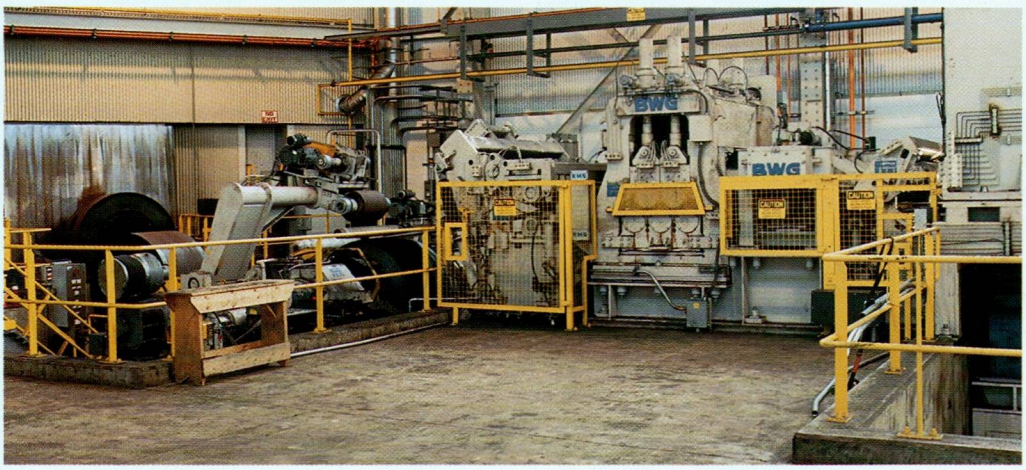
An intermediate accumulator is arranged downstream of the cold mills to achieve continuous line run during work roll change in the cold mills. The strip is then annealed in a five-zone furnace to soften the cold-rolled strip and create the desired material properties and grain size. The scale that has formed on the strip surface in the annealing furnace is removed in a turbulent-type shallow-bath pickling section. In the first bath, the strip is pickled electrolytically using sulphuric acid. Final pickling occurs in the second and third baths using mixed acid or nitric acid. After rinsing and drying, the strip surface is clean and has a matte (2D) finish. If desired, the strip surface finish can be brightened in a temper mill (2B). The temper mill features work roll bending and a preset algorithm for work roll bending as a function of strip thickness profile to achieve improved flatness after temper rolling. In the subsequent Levelflex® flexleveling operation any remaining out-of-flatness is eliminated resulting in an end product of superior flatness.

The exit accumulator ensures continuous line run during exit coil change. The strip can be inspected in a vertical and horizontal inspection station before it is rewound. For surface protection, paper is interleaved into the coil by one of three semiautomatic paper unwinders. The finished coil is conveyed by the exit coil car to an automatic banding machine and then to exit coil deposits, from where it is discharged by overhead crane.

The highly automated DRAP Line is designed to produce a high quality cold-rolled stainless steel product in less than one hour, with fewer operating personnel, reduced energy consumption and higher yield in a more environmentally friendly manner than the conventional production method. J&L Specialty Steel received the Pennsylvania Governor's Award for Environmental Excellence for the implementation of this innovative new technology. ■

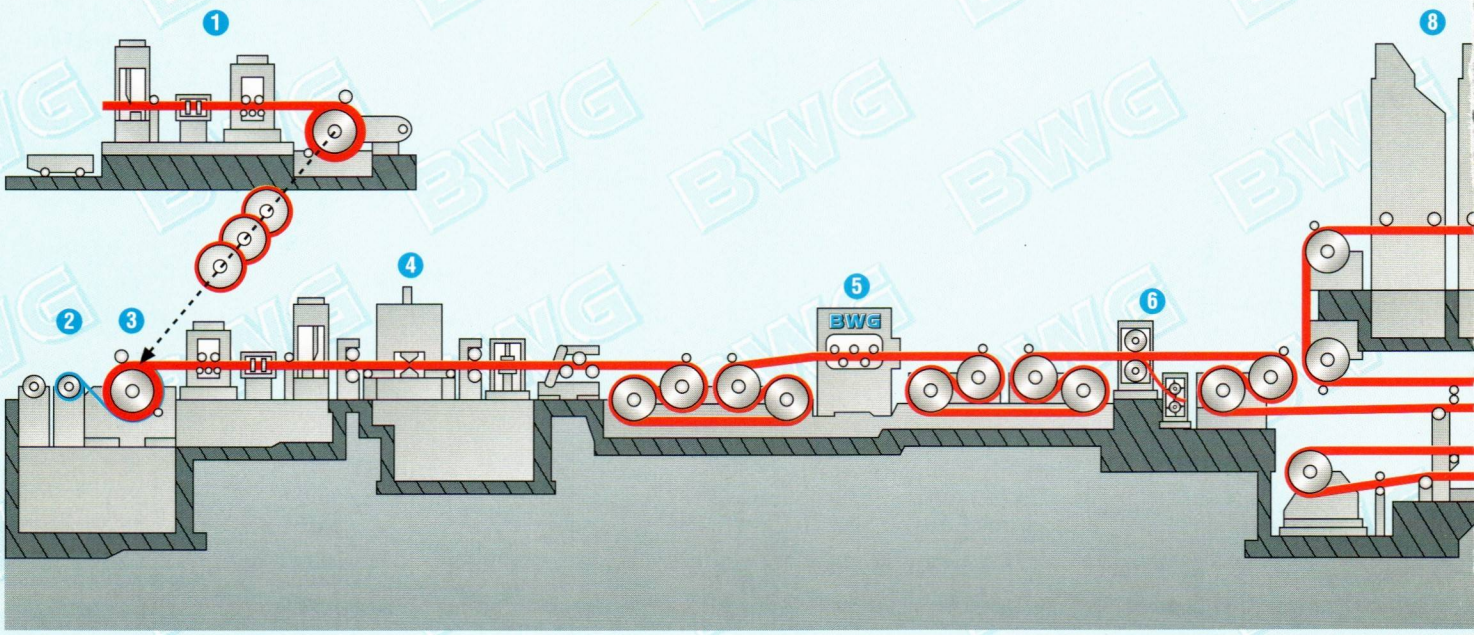
BWG DRAP Line





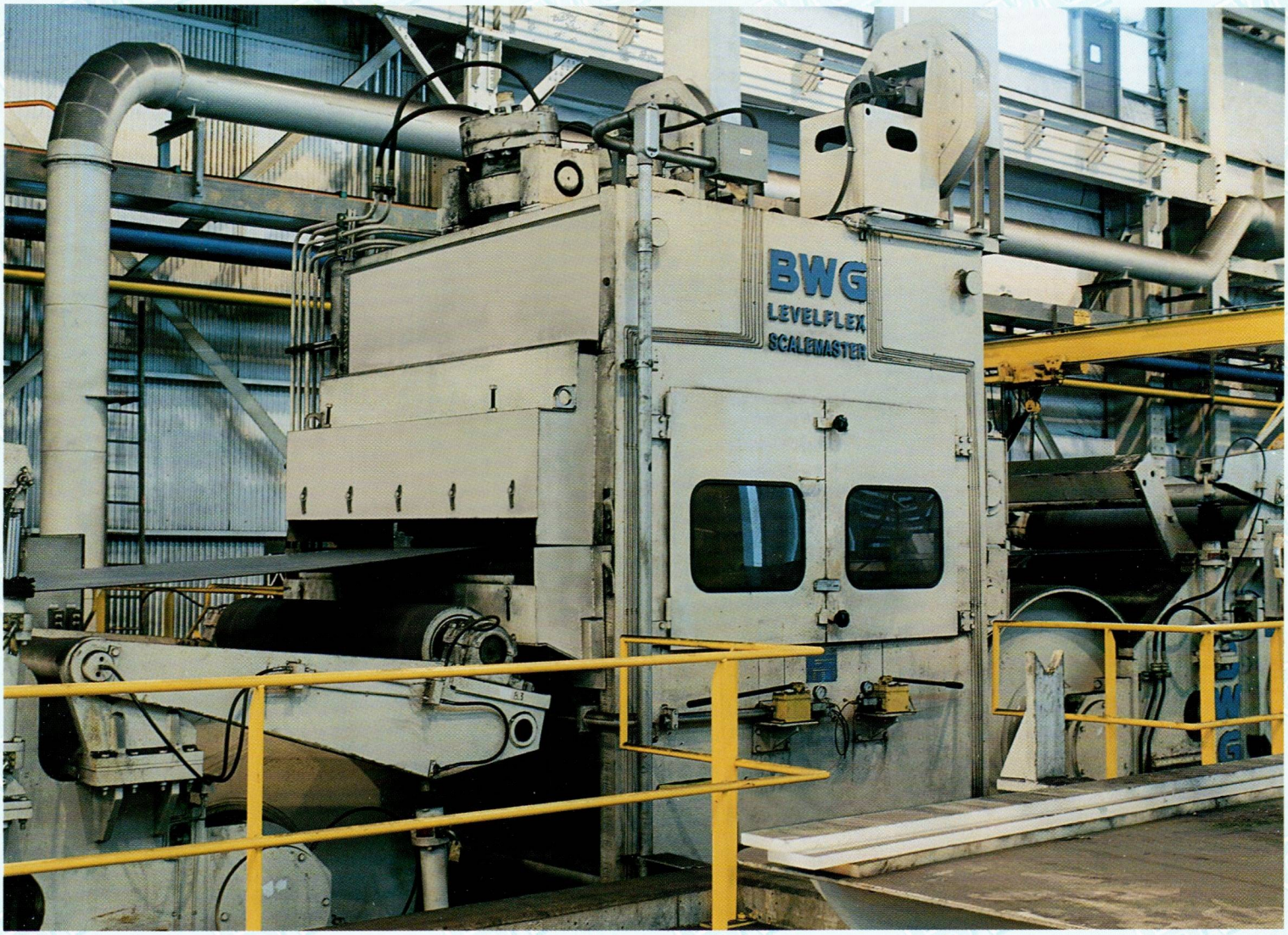
Coil Preparation Station

Entry Section

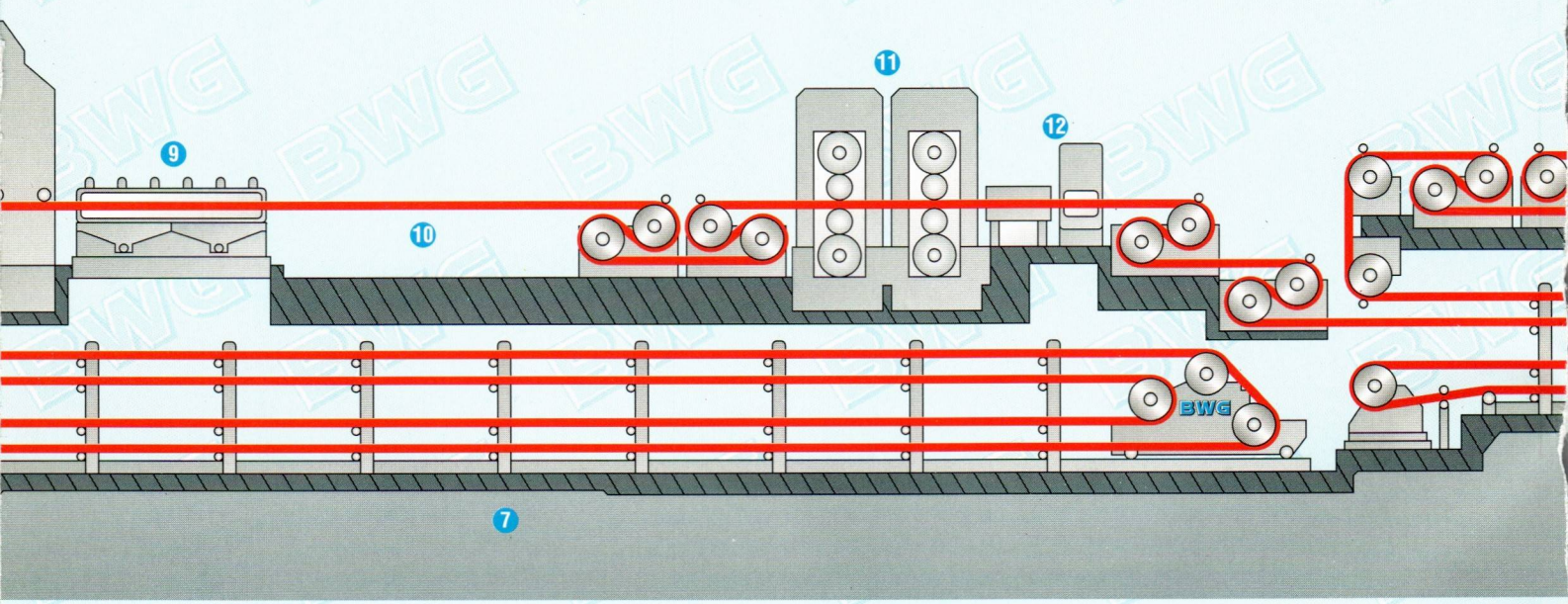


1. *Coil Preparation Station*
2. *Paper Rewinders*
3. *Pay-off Reel*
4. *Welding Machine*
5. *Scalemaster®*
6. *Side Trimmer & Scrap Cutter*
7. *Entry Accumulator*
8. *Shot Blast System*

Direct Rolling, Annealing & Pickling Line

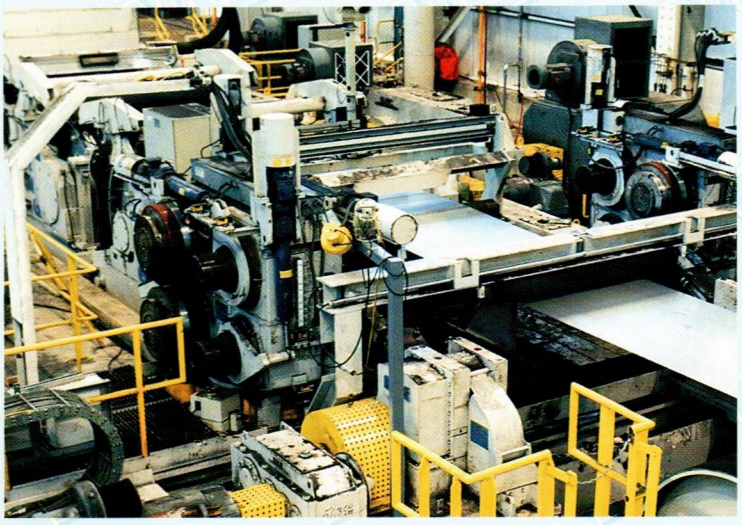


Scalemaster

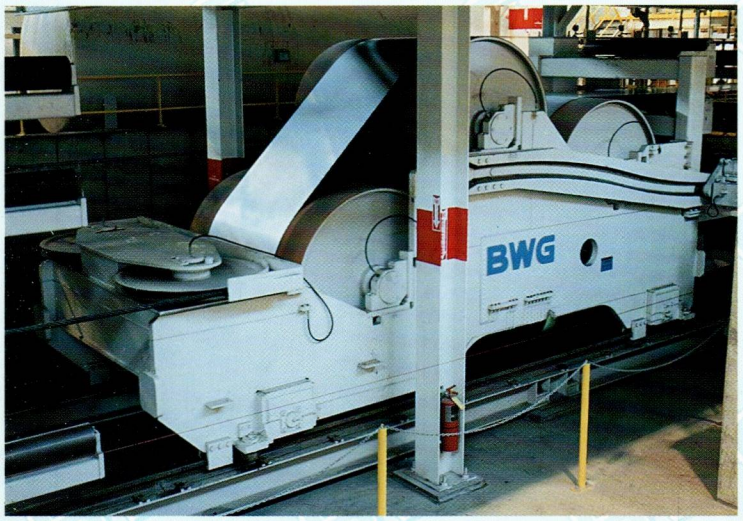


9 *Brush Polisher*
10 *Future Prepickling Section*
11 *Z-High Mills*
12 *Mill Cleaning Section*
13 *Process Accumulator*

for Stainless Steel Strips

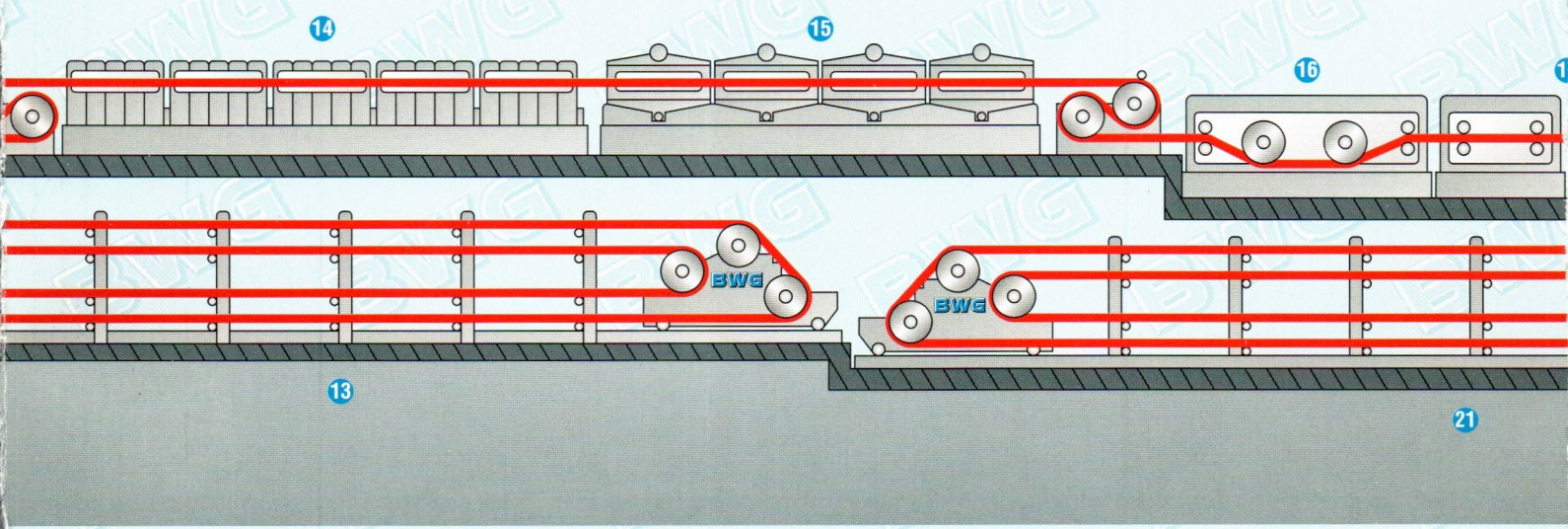


Side Trimmer



Looper Car

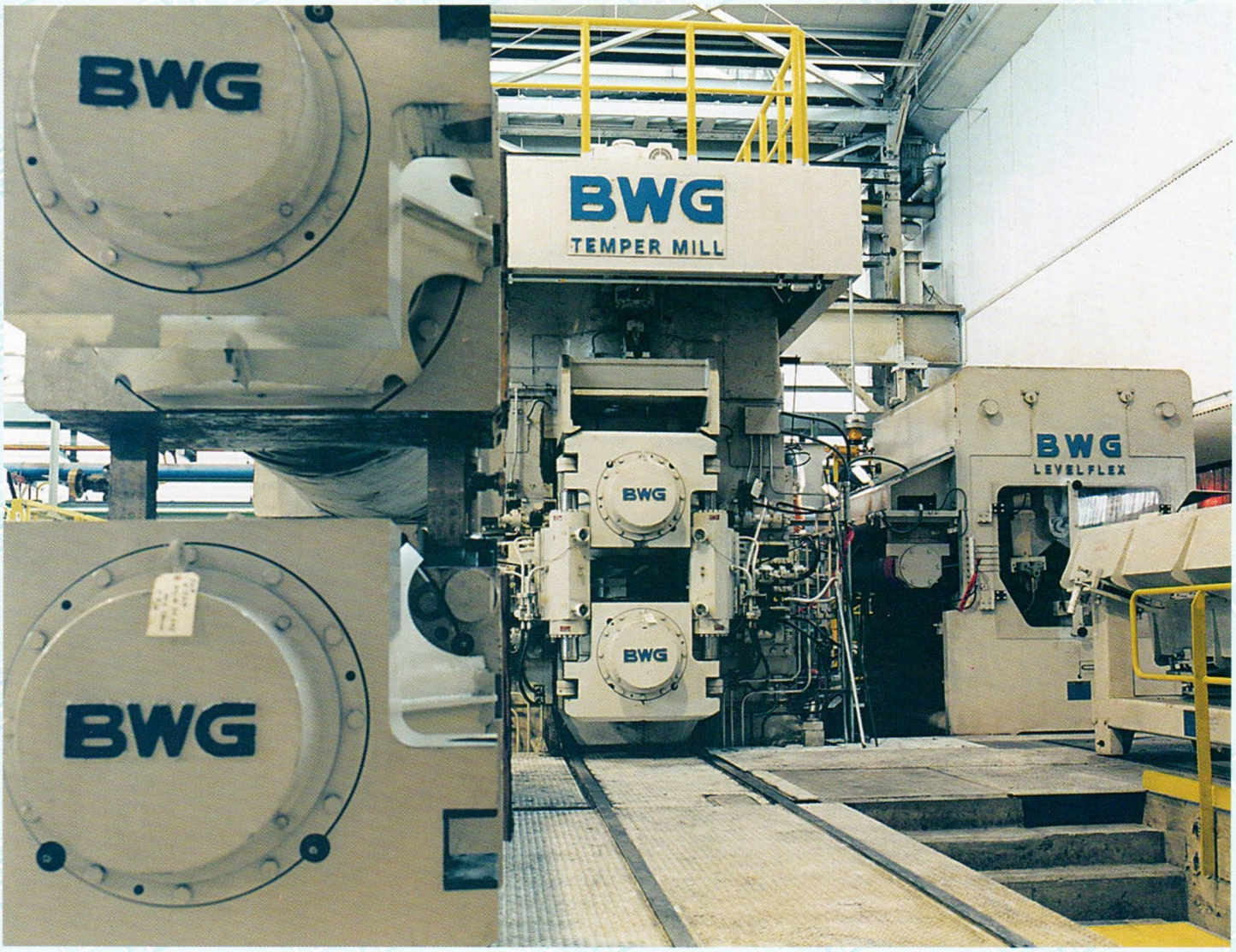
Accumulator



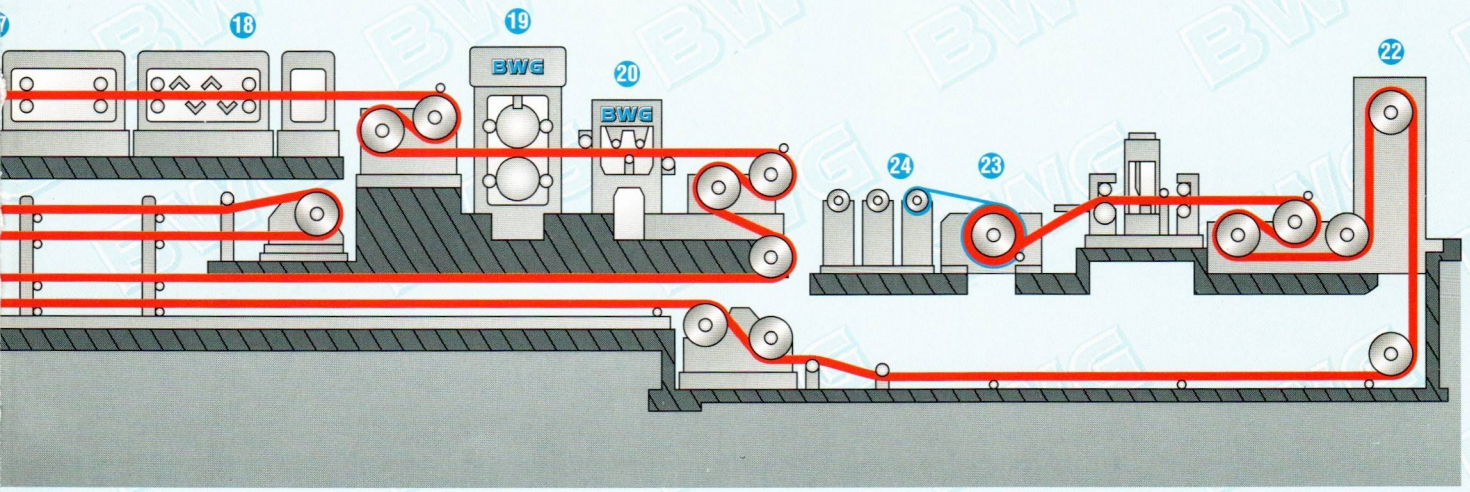
⑭ *Furnace*

⑮ *Cooling Zone*

⑯ *Electrolytic Pickling Tank*



Temper Mill



17 *Mixed Acid Pickling Tanks*
18 *Brushing and Rinsing Section*
19 *Temper Mill*
20 *Levelflex®*
21 *Exit Accumulator*
22 *Inspection Section*
23 *Tension Reel*
24 *Paper Unwinders*